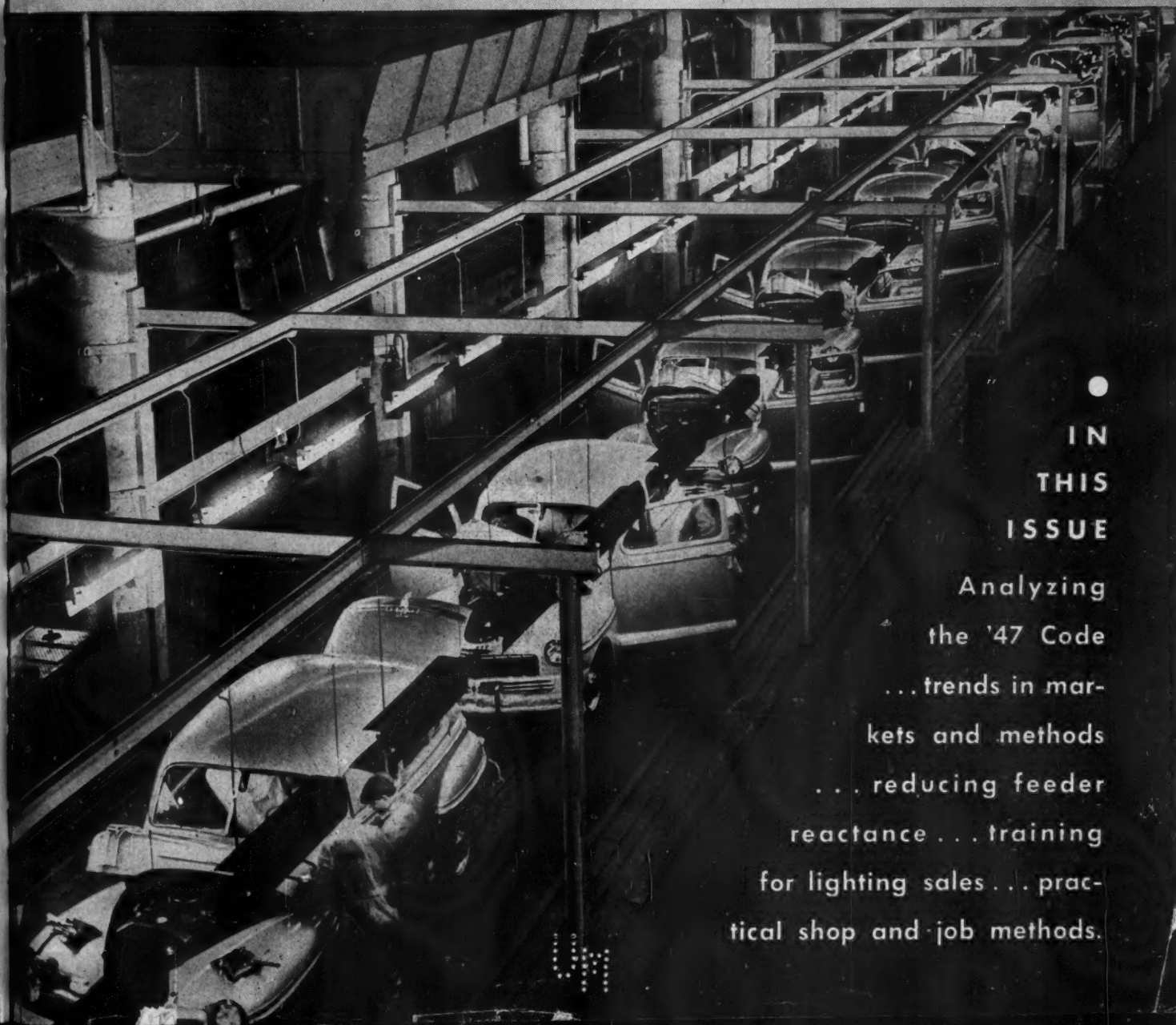


Electrical Contracting

JANUARY • 1947

THE MAGAZINE OF ELECTRICAL
CONSTRUCTION & MAINTENANCE



●
IN
THIS
ISSUE

Analyzing
the '47 Code
... trends in mar-
kets and methods
... reducing feeder
reactance ... training
for lighting sales ... prac-
tical shop and job methods.

need POWER-FACTOR IMPROVEMENT for FLUORESCENT LAMP FIXTURES?



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**Listed by Underwriters' Laboratories, Inc.



DATA FOR 60 CYCLE, 118 VOLTS A-C

Lamp Size Watts	1 Lamp	Approx. P-F	2 Lamps	Approx. P-F	3 Lamps	Approx. P-F	4 Lamps	Approx. P-F
15-T-8	S	95	M	86	L	95+	L	86
15-T-12	S	86	S & M*	95+	L	88	S & L*	87
20-T-12	S	90	M	85	M & L*	91	L	85
30-T-8	M	85	L	85	M & L*	86	L & L*	86
40-T-12	M	86	L	86	M & L*	86	L & L*	86

Symbols: S—Cat. No. 21F296; M—Cat. No. 21F297; L—Cat. No. 21F298

*Two capacitors in parallel

VOLT-AMPERE RATINGS

Volts A-C	21F296		21F297		21F298	
	50 Cycle	60 Cycle	50 Cycle	60 Cycle	50 Cycle	60 Cycle
118	21	25	33	39	66	78
208	65	78	102	123	204	245
236	83	100	131	157	262	314

*Pyranol is General Electric's registered trade name for a nonflammable liquid dielectric for capacitors.

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A practical technical and management journal for electrical contractors, industrial electricians, inspectors, engineers and motor shops, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction and maintenance.

Electrical Contracting

Contents for January, 1947

With which is consolidated The Electricist and Electrical Record . . . Established 1901

January—at a glance	37
An Era Begins	39
The Road Ahead	41
By W. T. STUART—An appraisal of the trends and opportunities in the critical year ahead for electrical construction, installation and maintenance.	
Analyzing the '47 Code	43
By JOHN M. TURNBULL—The 1947 National Electrical Code changes analyzed and diagrammed.	
Spot Conversion Pays	48
By GEORGE E. WALTERS—Electronic rectifiers on individual machines effect dual savings through more efficient operation and reduced maintenance.	
Lighting Program for Contractors	50
By BERLON C. COOPER—The story of the Sales Lighting Program developed by NECA and G.E. for contractors in order to stimulate greater interest in the huge sales lighting market.	
Scrambled Phase Transmission	52
By HUGH P. SCOTT—Compact split-phase configuration of busbars and fibrous-glass insulation are features of weatherproofed 4000 ampere low loss feeder installation.	
Industrial Electrification	81
Overload Protective Devices—Part III	

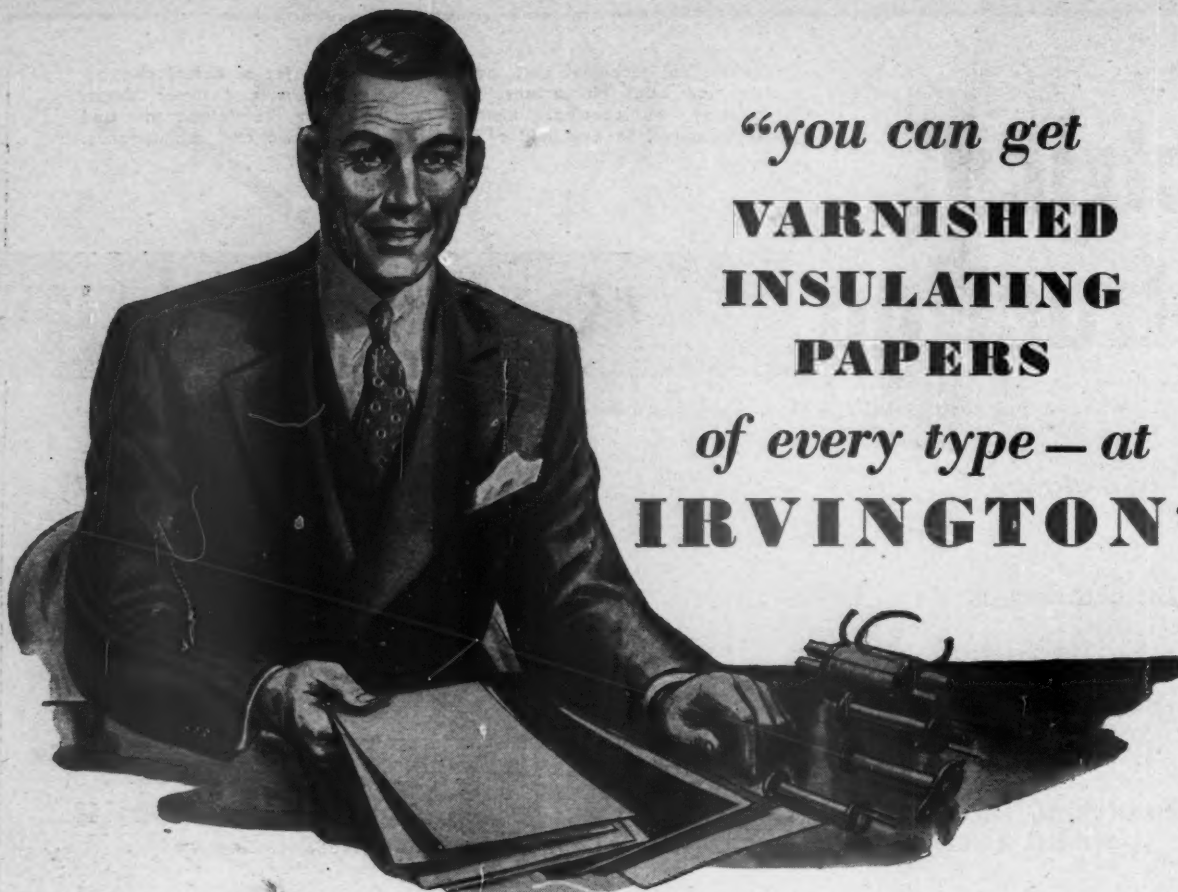
Departments

Practical Methods	57	Motor Shops	99
Equipment News	63	Questions on the Code	107
Modern Lighting	69	In the News	115
Reader's Quiz	90	Manufacturers News	124
Advertisers Index		142	

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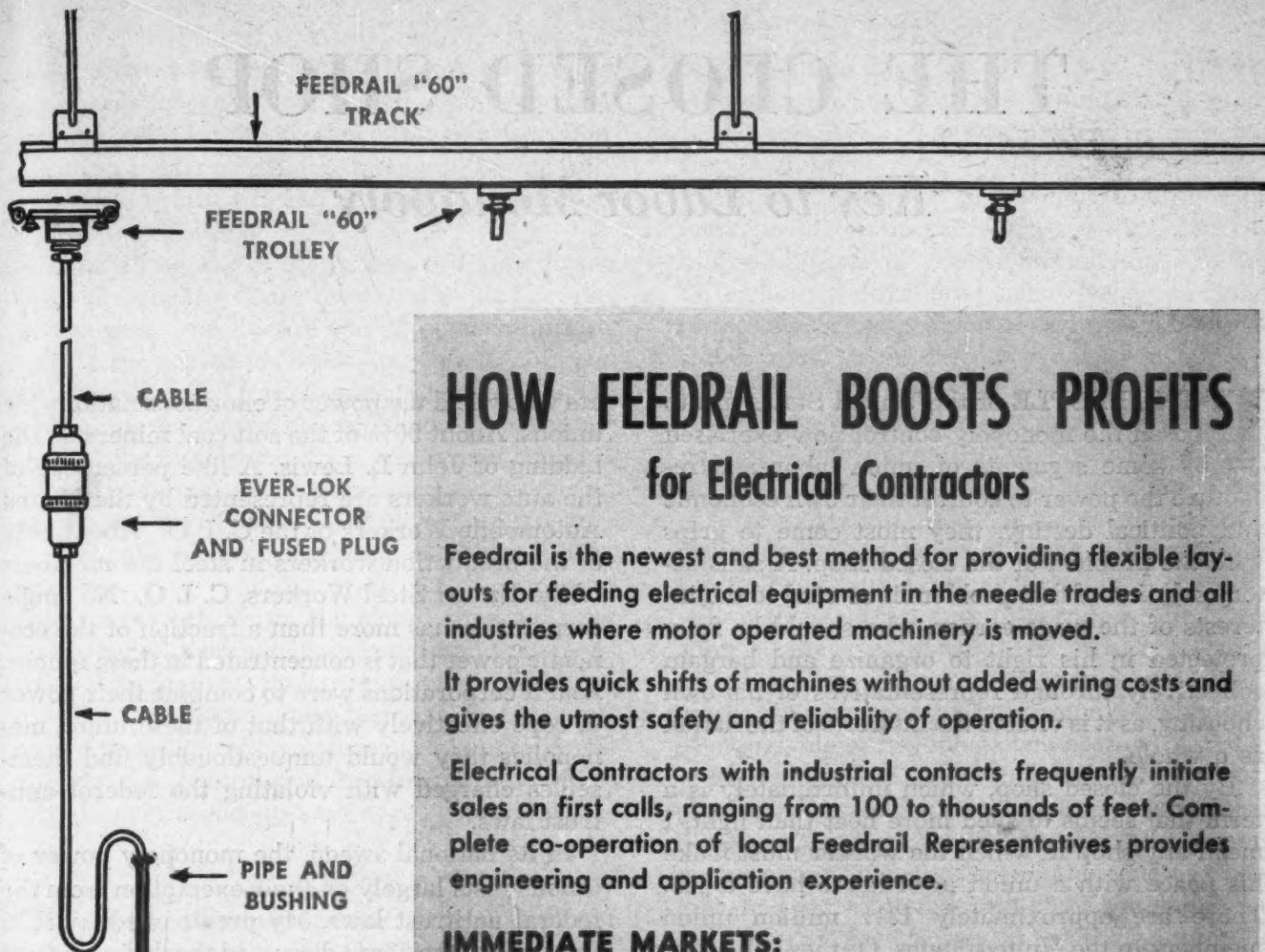
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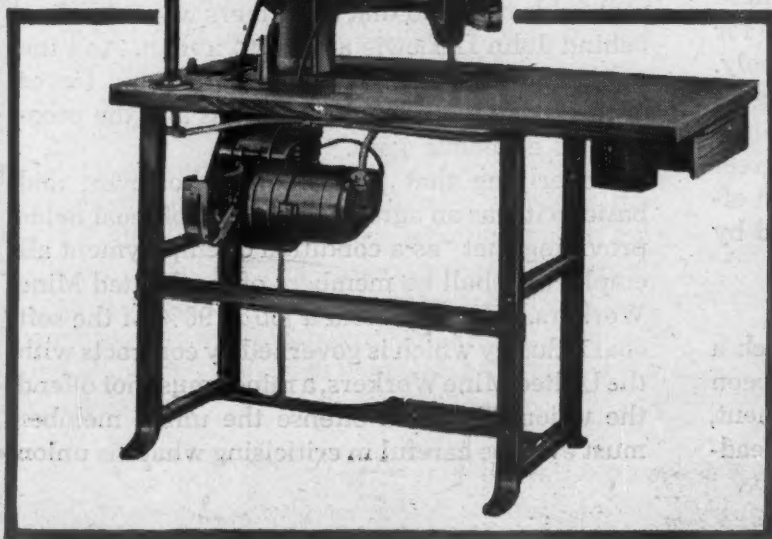
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THE CLOSED SHOP

Key to Labor Monopoly

IF THE PEOPLE of the United States are to loosen the monopoly control now exercised by some segments of union labor and recapture the power to control their own economic and political destiny, they must come to grips with the problem of the closed shop. A satisfactory solution of that problem is as vital to the interests of the wage earner, who should be fully protected in his right to organize and bargain collectively through representatives of his own choosing, as it is vital to the interests of the nation as a whole.

By the closed shop, which unfortunately is a term that seems to shed more heat than light, I mean any shop in which the worker must make his peace with a union in order to have a job. There are approximately 13½ million union members in the United States. Of these about 10 million are governed by arrangements calling for "closed" shops, union shops, maintenance of membership provisions and similar devices which make good standing in a union a condition to holding a job.

Such arrangements raise serious issues about what is commonly presumed to be the basic American right to work. Also, closed shop arrangements lie at the root of the dominant economic power now exercised by some labor leaders.

The problem of reducing the power of these labor leaders to proportions that make it safe for democracy is the age-old problem of monopoly. In an earlier era this problem was created largely by businessmen who sought to escape the restraints of competition by combinations or agreements to control prices and production. Such efforts are still attempted and must be curbed by law.

Union Labor Monopoly

But, after more than a decade during which a monopoly position for organized labor has been aggressively promoted by the federal government, the major monopolists today are those labor lead-

ers who wield the power of enormous nationwide unions. About 90% of the soft coal miners do the bidding of John L. Lewis. A like percentage of the auto workers are represented by the United Automobile Workers of the C. I. O. About 80% of the production workers in steel are members of the United Steel Workers, C. I. O. No single corporation has more than a fraction of the economic power that is concentrated in these unions. And if corporations were to combine their power to cope effectively with that of these union monopolies they would unquestionably find themselves charged with violating the federal anti-trust laws.

In its national sweep, the monopoly power of unions rests largely on their exemption from the federal antitrust laws. My previous editorial in this series (the 53rd) discussed the desirability of removing that exemption. The local roots of this monopoly power are often embedded in closed shop arrangements.

Closed Shop in Coal

An illuminating case in point is provided by the United Mine Workers, whose leader John L. Lewis has graciously given the country a 3½-month reprieve from "the hysteria and frenzy of an economic crisis," as he himself termed it. During that latest crisis the dispatches from the soft coal fields reported that the miners were standing behind John L. Lewis almost to a man. And the implication usually was that the driving forces of the strike were loyalty to Lewis and the prospect of economic gain.

Underlying that performance, however, and basic to it was an agreement in the soft coal fields providing that "as a condition of employment all employees shall be members of the United Mine Workers." Hence to hold a job in 90% of the soft coal industry which is governed by contracts with the United Mine Workers, a miner must not offend the union. To avoid offense the union member must even be careful in criticising what his union

does. *Suspension from the union for six months, and hence from the right to hold a job*, is the penalty imposed by the United Mine Workers constitution for circulating a statement "wrongfully condemning any decision rendered by any officer of the organization."

The willingness of the miners to follow Lewis until the country froze over was not, of course, exclusively a product of the agreement limiting jobs in the coal fields to union members of good standing. Some of it originated in bad handling of employee relations in the coal fields in years gone by. But the fact remains that Lewis' soft coal monopoly has as one of its principal foundations an agreement which gives the United Mine Workers a job-or-no-job hold on 90% of the soft coal miners.

In its extreme form, the closed shop not only makes union membership a condition of employment but narrowly limits the numbers admitted to union membership and hence to the opportunity to work. In this way it is used to enforce restriction of output and working rules which would never stand up under free competition.

Fair Dealing

The closed shop raises major issues of personal freedom and fair dealing between individuals. As matters now stand, closed shop agreements require employers to discharge workers who lose their good standing in the unions involved. At the same time they frequently impose no requirement on unions to grant membership to law abiding and technically qualified persons. Many unions with closed shop agreements refuse to grant membership on the basis of competence. Thus, qualified workers are denied a fair chance to hold a job.

In its dealings with the closed shop issue the federal government has been pushed into a self-contradictory position. The National Labor Relations Act (the Wagner Act) provides, and properly, that "employees shall have the right . . . to bargain collectively through representatives of their own choosing." In furtherance of that basic proposition, the Wagner Act also provides that "It shall be an unfair labor practice for an employer . . . by discrimination in regard to hire or tenure of employment to encourage or discourage membership in any labor organization . . ." Standing alone, the provision would clearly outlaw the closed shop.

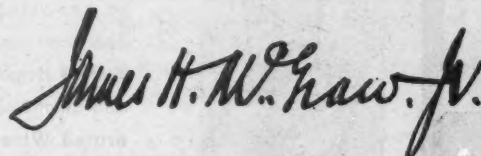
But then, to favor the closed shop, the Wagner Act turns right around and provides that "nothing in this Act . . . shall preclude an employer from making an agreement with a labor organization . . . to require, as a condition of employment, membership therein," provided that certain conditions of representation are fulfilled. This places the National Labor Relations Board in the impossible position of trying to administer a law which simultaneously points in opposite directions.

In successfully contending that there should be no closed shop arrangements on the railroads, the late Joseph Eastman, Federal Co-ordinator of Transportation, said, "If genuine freedom of choice is to be the basis of labor relations under the Railway Labor Act, as it should be, then the yellow dog contract and his corollary, the closed shop . . . have no place in the picture." The so-called yellow dog contract, which requires a worker to agree not to join a union as a condition of employment, has long since been outlawed.

At one time the closed shop was defended as a protective device for feeble young unions struggling against predatory employers. But a mere glance over the current economic scene discloses that the time when that argument was supported by the facts is past. Now it is the labor leaders who frequently exercise decisive economic power.

At elections in November three more states, Arizona, Nebraska and South Dakota, passed constitutional amendments outlawing the closed shop. In doing so, they joined six other states, which, in one way or another, have restricted the closed shop. The South Dakota amendment presented the basic issue created by the closed shop in simple and direct terms when it declared that "The right of persons to work shall not be denied or abridged on account of membership or non-membership in any labor union, or labor organization."

That issue must be squarely faced by the new Congress if its first order of business, the labor crisis, is to be resolved.



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JANUARY at a Glance

New Code

The new 1947 Revision of the National Electrical Code is required reading for most of us during the next month or so. Whether your copy is in the familiar pocket size or in the new red cloth covered library edition put out as Volume V of the National Fire Code by the National Fire Protection Association, you will find John Turnbull's code analysis on page 43 a useful guide and reference to the more important changes.

Specifications

Our September 1946 issue included a 72-page editorial feature section on Electrical Specifications. Extra copies of the issue were exhausted so rapidly that the overwhelming number of requests could not be filled. Reprints of the Master Electrical Specification are now available, we are happy to report, at \$1.00 each. Address your orders to our editorial department.

Lamp Tax

President Truman's proclamation officially terminating hostilities on December 31 automatically schedules the end on July 1 of a number of wartime excise taxes. A particularly

welcome one is the reduction of the tax on lamps from 20 percent to 5 percent. While almost any method of raising revenue in wartime is acceptable, it is notable that lamps are in a unique category among products subject to excise taxes. Most are luxuries, all are products or services over which the individual can exercise choice as to whether he will buy or not. The lamp, however, is just about as universally essential to everyday life as any manufactured product can be. In direct contradiction to sound tax policy, the excise tax on lamps hits hardest at the lowest income levels.

Fire Warning

Hotel disasters in recent months prove the inadequacy of fire detection and warning facilities. Electrical fire and smoke detection equipment is neither expensive nor difficult to install. It should be required by law. Effective warning systems to arouse guests, guide them to exits and allay panic are not so easy. Conventional fire signals alone, effective enough in a familiar environment, may aggravate panic and confusion in strange surroundings. A recent development may be the answer. A separate circuit to the individual room radio speakers permits the operator to cut in at full volume, arouse the guests, issue instructions and quiet panic.

Apprenticeship

At the end of last October there were 13,487 apprentice electricians listed by the Apprentice-Training Service of the Department of Labor. The number is on the upgrade but not fast enough if the skilled labor supply is going to keep up with industry expansion. The only way to insure a high level of craftsmanship for the years ahead is to train apprentices now. NECA, through Ed Herzberg and his apprenticeship committee, is taking an active part in a program to stimulate apprentice training in all the building trades. It is a worthwhile effort that will be paying dividends to all the industry for years to come.

Lighting Show

Plans are under way for the second International Lighting Exposition and Conference to be held in Chicago at the Stevens Hotel, November 3 to 7. Last spring, the first show proved an overwhelming success and established a high precedent. This year's exposition promises to be bigger and better. Much more new equipment will be displayed. The conferences which proved popular far beyond expectations will be further expanded. Sponsored by the Industrial and Commercial Lighting Equipment section of NEMA, it is an educational venture that benefits the entire industry. It deserves enthusiastic support.

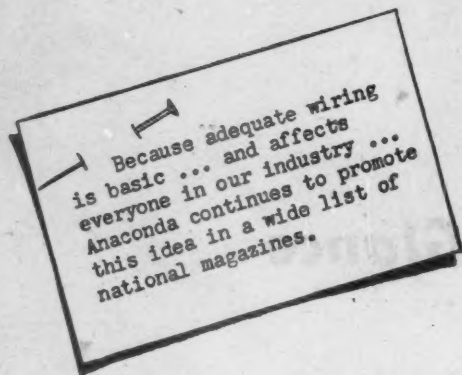
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AN ERA BEGINS

ABOUT 1960 we'll have a name for these times. Every war in history has been followed by a vigorous assault on some new frontier, an awakening of adventure toward new horizons. We can't find a clue in '46. The spirit of adventure was conspicuously lacking. Many bold "postwar" plans were shelved without ceremony while folks turned from future objectives to the immediate chores of labor relations, material supply and production schedules.

BUT DYNAMIC ECONOMIES cannot stand still. Our's is moving ahead even though the direction is not yet clear. And out of it will rise new industries, new products and new ways of life. After the first world war it was new construction, automobiles and radio which, with related industries, gave our economy new strength. What now?

THE APPLICATION OF ELECTRIC power to industry, commerce and the home followed a strong upward course before the war then a sharp acceleration due to wartime industrial development. The months following the war brought no decline but actually set new records. If electrification were approaching its peak, there would be signs now. There are none. On the contrary, there is every evidence that the use of electric power is only beginning.

WITH DUE CAUTION, we can make some reasonably definite predictions from the above. 1) The years ahead will see vastly greater use of electric power, and, 2) The great new postwar industries, whatever they may be, will involve the electrical industry and its products to a major degree. And these predictions are the very minimums upon which we dare project our 1947 plans.

WHILE DESTINY GRANTS US such enviable opportunity, it might be well to look at what we are doing about it. A few, a very few, of our new era homes are wired for some of the newer appliances. Most don't even come up to our present utilization needs. A few of our newer industrial plants are powered and lighted with network systems under competent maintenance capable of meeting '47 production schedules and beyond. The rest are still yanking the last possible ampere off overloaded feeders to meet urgent momentary needs.

LIGHTING, A TECHNIQUE which has grown tremendously in recent years, can point with pride to many new modern installations geared to the new era. But the general run of lighting jobs today belong to the tempo and standards of the late '30s. Furthermore, we haven't begun to apply what we know about lighting to the home—a lush, untouched market of fantastic proportions.

THE TIMES AND THE NATIONAL SCENE have forced business caution and careful management during 1946. The problems have been serious but largely abnormal and temporary. They must not dull our senses to the evidences of the great era that is in the making. If we believe in the destiny of this industry, it must be reflected in the quality and adequacy and progressiveness of today's jobs. The new era will be as well equipped electrically as we are willing to make it.

Wm. F. Stuart

Electrical Contracting—JANUARY, 1947

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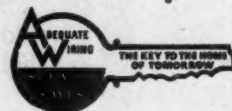
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The ROAD AHEAD

Appraising '47 for its trends, opportunities, and problems
in the field of electrical construction and maintenance.

By W. T. Stuart

ANY appraisal of the months ahead must be drawn in the environment of the moment, against the background of recent history. This is no exception. But in looking down the road ahead we have tried earnestly to weigh the affairs of the moment in objective terms, not so much as they appear now but more as they will seem on looking back from midyear or the end of the third quarter.

Year end reports from many electrical industry sources view the coming months with confident optimism. Another round of strikes, a somewhat vague possibility of a recession or other economic maladjustment can upset predictions. But the trends are toward greater stability in labor relations rather than less, toward more production and more business rather than a falling off, and toward a better, rather than a worse, economic balance.

The optimistic factors, a tendency of folks to settle down, a growing population curve, money in the bank, relief from irritating shortages, a leveling off of prices in many lines are strong economic forces which cannot be easily stopped or diverted.

And the electrical industry is on the high road again with heavy backlogs of material orders, new records in kwh. consumption, a record construction market in prospect and an avid public appetite for all its goods and services.

New construction during 1947 is variously predicted between 16 and 22 billions of dollars. The actual figure

is not as significant as the apparently unanimous optimism that a new record will be set this year in dollar volume and probably in physical volume of new construction in place. While this is a hopeful outlook, it seems the better part of wisdom to view the apparent prospects with some restraint. It is evident that the demand and the need are tremendous. But there are certain fairly clear limitations which will inevitably retard such a vast acceleration in new construction.

Lets look at some.

- 1) The war time high in construction employment was reached in '41 and '42 and involved a high percentage of overtime. To reach the same volume of construction would require a large increase in the ranks of skilled labor or a revolution in construction technology, neither of which are likely in '47.
- 2) Much of the construction backlog was planned against a budget appropriation at OPA levels. Prices are up. Projects are being shelved or abandoned. Government projects are being pigeonholed pending new legislative appropriation. Such action takes time. Many major projects planned for '47 won't start until well along in '48.
- 3) Materials production, though growing rapidly, won't meet current demands until midyear by the most hopeful predictors, and spot shortages, critical items

which can hold up job progress, may be-devil the industry through the year.

- 4) The supply of competent management and supervisory personnel is sharply limited. Such men take years to train, are rarely available from other industries and are already run ragged at today's volume.

These are limiting factors. They are useful for critical appraisal of the potentials ahead. They are pessimistic, however, only in a relative sense. They limit the *rate* at which we can grow, not the eventual goals which we can achieve.

Electrical work associated with new construction will almost certainly reach a new high in total dollar volume. The trend toward a higher percentage of the construction dollar devoted to electrical work is still evident and will continue to rise as new utilization requirements must be met with more wiring and more apparatus per cubic foot of structure. A conservative estimate of 1947 electrical work would be in the order of 1 billion dollars and involve about 26 million man hours of skilled labor.

Residential work in 1947 based on the current rate of building will involve approximately 275 million of dollars for electrical work. This may easily be exceeded as price limitations are lifted and industry promotional activity can work unhampered. Even a moderate improvement in electrical work per home; an extra outlet or two,

ESTIMATE OF 1947 ELECTRICAL CONSTRUCTION

Total Electrical Construction	1,217,100,000
New Construction Total	1,002,000,000
PRIVATE	759,500,000
Residential (non-farm).....	238,000,000
Non-Residential.....	405,000,000
Farm.....	24,000,000
Utility.....	92,500,000
PUBLIC	243,100,000
Residential.....	36,000,000
Non-Residential.....	36,000,000
MILITARY AND NAVAL	16,800,000
HIGHWAY	120,000,000
OTHER	34,300,000
Repairs to Buildings.....	214,500,000

Estimates extended from U. S. Department of Labor estimates of current construction running at a 15 billion annual rate.

larger service entrance conductors, a higher percentage of range and water heater installation, or a popular demand for bathroom heaters; can up the total enormously in a very short time. And the trends are very evidently in that direction. House wiring remained so long at the far end of the electrical parade it is going to need a lot of help and attention to bring it up where it belongs. The coming year offers an extraordinary opportunity to establish new frontiers in house wiring.

It's a safe bet that no farms wired before the war are adequately wired according to today's requirements. At long last it looks like rural wiring is gaining recognition as a specialized field. The coming year will see an important upturn in rural wiring activity and more specialized cables and wiring materials for farm use.

In most early farm electrification the new power was used primarily for lights and household appliances. The application of electric power to actual farm operations is gaining with tremendous speed. Modern farm wiring is more analagous to a specialized industrial installation than to residential work. Further, fire and shock hazards and continuity of service are far more important on the farm than most other applications of wiring. Trends are toward better and more specialized wiring practices, with less concern for minimum first cost and more for reliability and safety.

And any appraisal of the farm market must take into consideration the improved economic position of the

average farmer. His cash income in the last few years is the highest in history, further, there is every indication that, though food prices have passed their peak, they will probably stabilize at substantially profitable levels. The farm is a good market for quality.

Cost conscious management is looking with more than usual interest on maintenance. With production schedules difficult enough to achieve with material shortages and labor problems, it is important to keep the wheels turning when they start. There is a trend toward more emphasis on preventive maintenance, scheduled replacements and routine check-up to stop trouble before it happens.

The coming year will show a better supply of apparatus available and better deliveries with electrical maintenance departments becoming more critical about features that contribute to reliability, performance and easy up-keep.

Nearly 2,000,000 new customers were added to utility lines in 1946 with this year expected to exceed that score. Residential consumption of electricity climbed to the all-time high average of 1,330 kwh. per customer with the new year expected to exceed that by a comfortable margin.

Electric companies plan to add about 8,500,000 kw. in generating capacity over the next three years with 2,400,000 kw. scheduled for 1947. Construction is expected to approach one billion dollars in 1947.

In the electrical construction fields no critical labor problems are expected

at the labor-management level. A long history of cooperation and mutual confidence in meeting joint problems has made the industry strikeless.

Hourly rates are considered of less importance than unit costs derived from the product of the rate times the average efficiency. In some areas this unit is receiving close analysis from both labor and management, with an eye toward its improvement through; 1) reduced non-productive time, 2) more use of specialized methods and power tools, 3) better job handling methods.

The electrical construction industry is taking a leading role in the building trades apprentice training program. Both labor and management are working to build a supply of competent mechanics to fill the ranks and restore the normal depletion.

No branch of electrical activity offers such a potential for spectacular growth than is evident in lighting trends. Spearheaded by the International Lighting Exposition in Chicago last spring, the industry has grown phenomenally with acute shortages of materials and components the only limiting condition. Many new lighting installations shows a distinct trend toward carefully planned lighting techniques to achieve specific lighting results, reaching into new high levels of illumination with much greater concern for light control and brightness reduction than ever before.

The obvious task of bringing existing obsolete lighting up to current standards, enormous as it is, is multiplied many times with each new step forward in current lighting progress. Such projects as the continuously louvered ceiling at the U.N. council chambers or the John David show windows in New York where each window has full theater stage equipment, are types of frontier jobs that will inevitably move the going standards of public demands for modern lighting far ahead.

A better supply of fixtures and components is predicted for early '47, even the possibility of fairly wide choice by midyear. But so far the public has pretty much grabbed fluorescent lighting away from a shortage-harrassed industry. What the potentials are with even a moderate amount of sales pressure and a broad scale effort to produce fine lighting results, no one can guess with any hope of accuracy. Lighting may well be one of those postwar industries that will rise to major economic importance in the years ahead.

ANALYZING The '47 CODE

THE NEW CODE CHANGES ANALYZED AND DIAGRAMMED

By John M. Turnbull

THE 1947 National Electrical Code provides for new methods of distribution, new utilizations of electricity, and new materials and control schemes which should be helpful to the industry and beneficial to the public. More power is being used by a great many more appliances, which calls for the maintenance of a judicious balance between adequacy of facilities and diversity of uses, all premised on practical safeguards for the full utilization of electric service.

New Materials

The things which are new since the code was issued in 1940 include improved rubber insulations, the new Code rubber to be rated at 60 degree C. (section 3012) which will result in allowable current-carrying capacities of conductors of about the same values as were given for the now-superseded type RP or performance grade (Table 1). For instance, Code grade rubber-insulated No. 4/0 will be good for 195 amperes. The old RP equivalent was 193 amperes. Type RH heat-resistant 75 degrees C. rubber values remain essentially unchanged except that, for practical purposes, their ampere ratings have been given in round figures, for instance, No. 3/0 which was rated at 199, now carries the value of 200 amperes. (Table 1).

The smaller sizes of rubber-insulated conductors will be of the thin-wall variety. Unmilled Latex type RV conductors are thin-wall, and available up

to No. 6 AWG. Nos. 14 and 12 conductors of R and RH rubber have been reduced by 1/64 to a 2/64 inch wall of insulation. Only RW moisture-resistant rubber will have the old heavy walls of insulation (section 93101f).

Thermoplastic insulations (formerly known as synthetic) type T and TW are thin-wall in the smaller sizes (section 93101f). These wires carry approval for general use up to and including No. 4/0. Larger sizes of thermoplastic wires may only be used for open work (section 3102).

Thinner insulations in armored and non-metallic sheathed cables, with resultant smaller diameters, will probably bring new fittings.

A new development is Type ACV varnished-cambric insulated armored cable in sizes No. 4 and larger intended for use as feeders in industrial plants (section 3342).

Terms change. Askarel is the name which has been given to those non-flammable liquids used as insulation in transformers and which will not burn (Article 100).

A preview of things to come is contained in the new article 390 wherein the wiring of Prefabricated Buildings has to be done in accordance with the Code.

New Methods

In addition to the radial system, in which a circuit is connected to a power supply at one end, only the 1947 Code approves the loop system of conductors

both ends of which are connected to power supply points (section 4513). Such network distribution systems were used extensively in large war plants to interconnect load-center transformer substations and thus provide multiple-supply power systems.

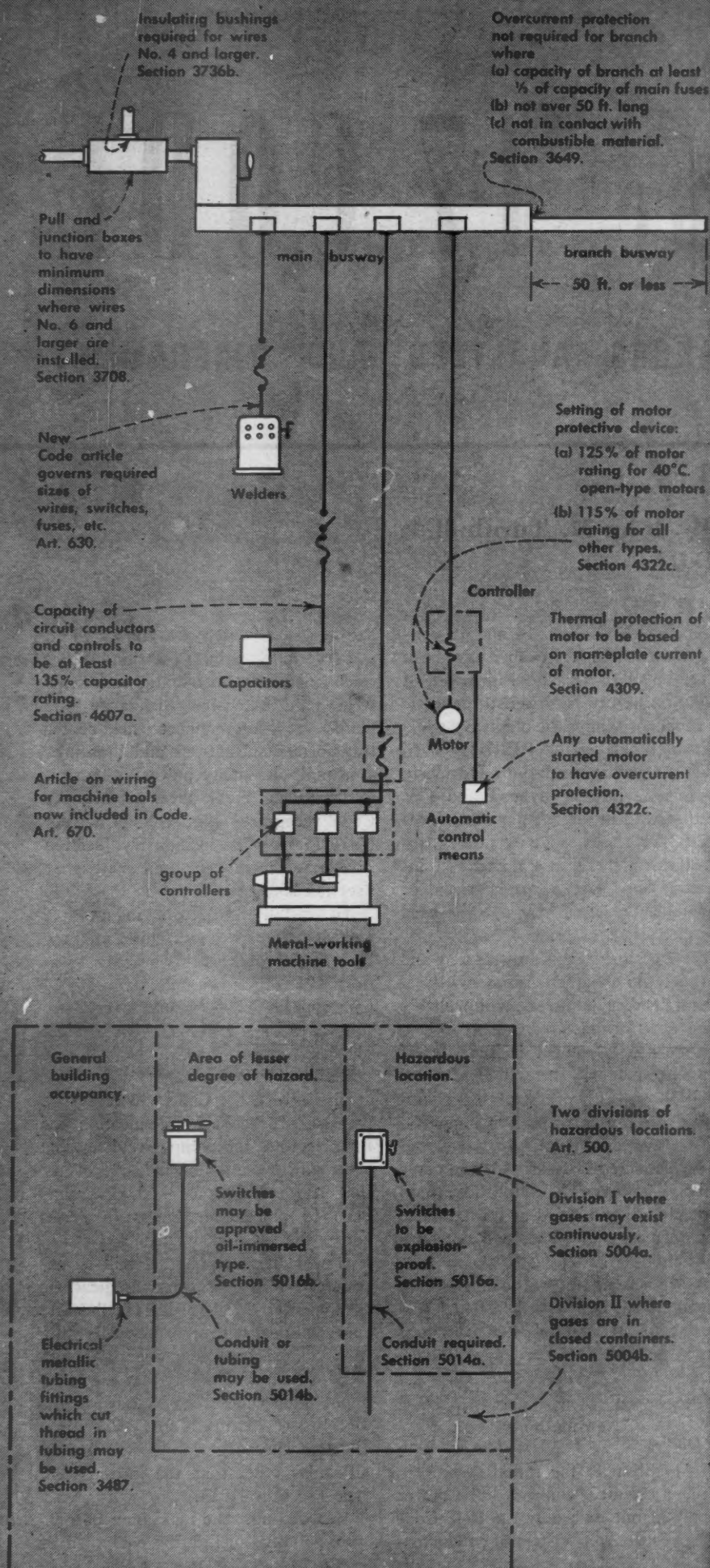
Paralleling these developments, the Code recognizes high-voltage wiring up to 15,000 volts in industry (section 7112), and metal-enclosed switchgear (section 2389).

To install conductors in multiple makes better use of circuits, and the Code now regulates this practice (section 3105). For example, two 250,000 CM type R cables could carry two times 215 or 430 amperes as against only 320 amperes for a 500,000 CM cable.

In contrast, the Code will recognize the use of the series connection for infra-red heating lamp circuits. The accepted connection of infra-red ovens, that run as high as 4,000 kw., has been to place four lamps in series across the 460-volt mains.

New values of potential will be encountered in lighting applications (Article 410): The Code for the first time will deal with fluorescent lighting in a comprehensive manner, although it is of historic interest that mercury-vapor lamp rules were included in the 1909 issue of the Code. The term Electric Discharge lamps will include all lamps other than the incandescent type (section 4101).

In dwellings, the maximum permissible potential of lighting equipment is



Changes in Code rules affecting industrial wiring installations.

1,000 volts (section 4183), with special safety provisions above 300 volts. In other occupancies, the limit for lighting systems is 15,000 volts (section 4191). The currents of these higher-voltage systems are limited to 240 milli-amperes up to 7,500 volts, and to 120 milli-amperes above that potential (section 4194).

Diversity of operation between appliances and parts of appliances is allowed for in circuits to welders (new Article 630), in feeders of residential occupancies to fixed appliances where the factor is 75 percent (section 2203e), and household range circuit where any range up to 12 kw. rating may be computed as an 8 kw. load (Table 29 and section 2203d).

A common neutral may be used for branch circuits (like it has been permissible for feeders) for lighting equipment installed outdoors on a single structure, as in a ball park (section 7312).

New installation regulations rule out solder lugs on service equipment (section 2358), the same prohibition as has applied to grounding conductor connections. Non-metallic sheathed cable may be run in concrete blocks (section 3362). Open wires may be run closer together—2½ instead of 4 inches—where spacers are utilized, thus effectively reducing the reactance and so increasing the useful capacity of such installations (sections 3204b and 3205). Electrical metallic tubing may not have ordinary threads cut in it, but special thread-cutting fittings have been approved (section 3487). ½ inch flexible metal conduit may be used under prescribed conditions (section 3503). The Garage rules of the Code encompass aircraft in addition to vehicles (Article 510).

New Utilizations

The new articles of the 1947 Code are Conductors (Article 310); Cabinets and Cutout Boxes (Article 373); Prefabricated Buildings (Article 390); Electric Welders (Article 630); Machine Tools (Article 670); Remote-Control, Low-Energy Power and Signal Circuits (Article 725); and the completely revised article on lighting fixtures, lampholders, lamps, receptacles and rosettes which combines old

Articles 410 and 420. Revised Article 500, Hazardous Locations, will be discussed later. Article 660 is now confined to x-ray equipment. High-frequency equipment will be treated separately.

Article 410 on lighting equipment will be of most general interest. Much of it is new, although many of its rules formerly appeared in the Code. Students of this new article should note its arrangement for a ready understanding of its contents. It deals progressively with fixture locations, outlet provisions, supports, wiring, and leads on to special provision for flush installations, low and high voltage fluorescents.

A fundamental concept appears in revised Article 500, Hazardous Locations, wherein the fringe areas on twilight zones surrounding or adjacent to locations of prime hazard may be treated as areas of secondary importance with some relaxation of wiring and equipment installation requirements.

Welders

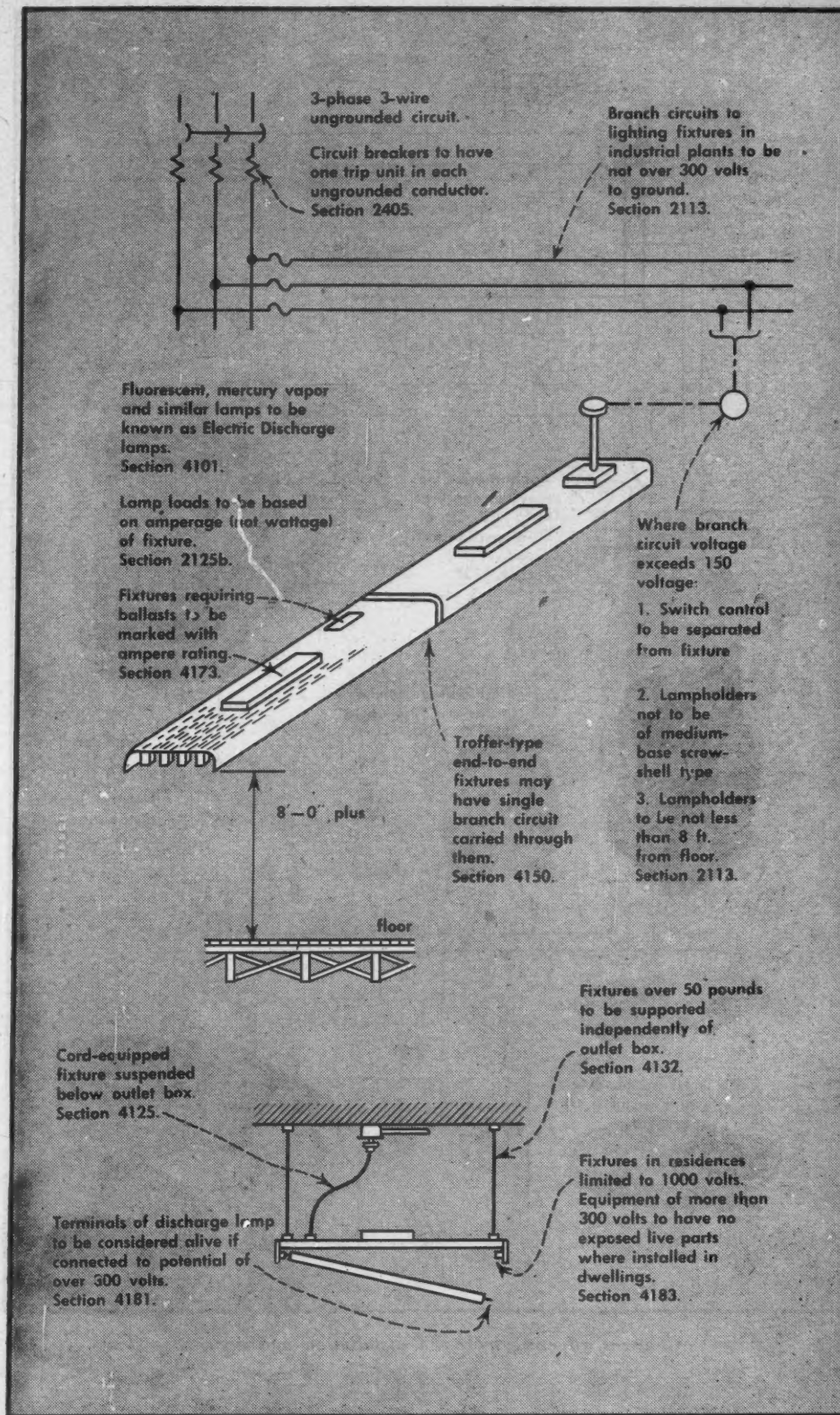
Welders are classified as to type—transformer, motor-generator and resistance—and particular allowances are made for the peculiar natures of these loads. For instance, transformer-arc welders may have overcurrent protection up to 200 percent of their rating (section 6312). A table of multipliers is given for resistance welders from which the minimum capacity of circuit conductors is obtained in conjunction with the application of factors of duty cycle (section 6331 a 2). For example, where the known duty cycle is 25 percent, the supply conductor capacity requirement is 50 percent of the primary current of the welder. A note of caution points out that voltage drop is often of more importance than rated current-carrying capacity of conductors (section 6331).

Article 670 sets up special provisions for metal-working machine tools and is not intended for application to other industrial occupancies where different conditions prevail (section 6701).

Infra-red lamp installations are treated as appliances, and the special rules on these applications are to be found in section 4237.

Improved Controls

The requirements to ground wiring systems in outbuildings should provide more positive clearance of faults which

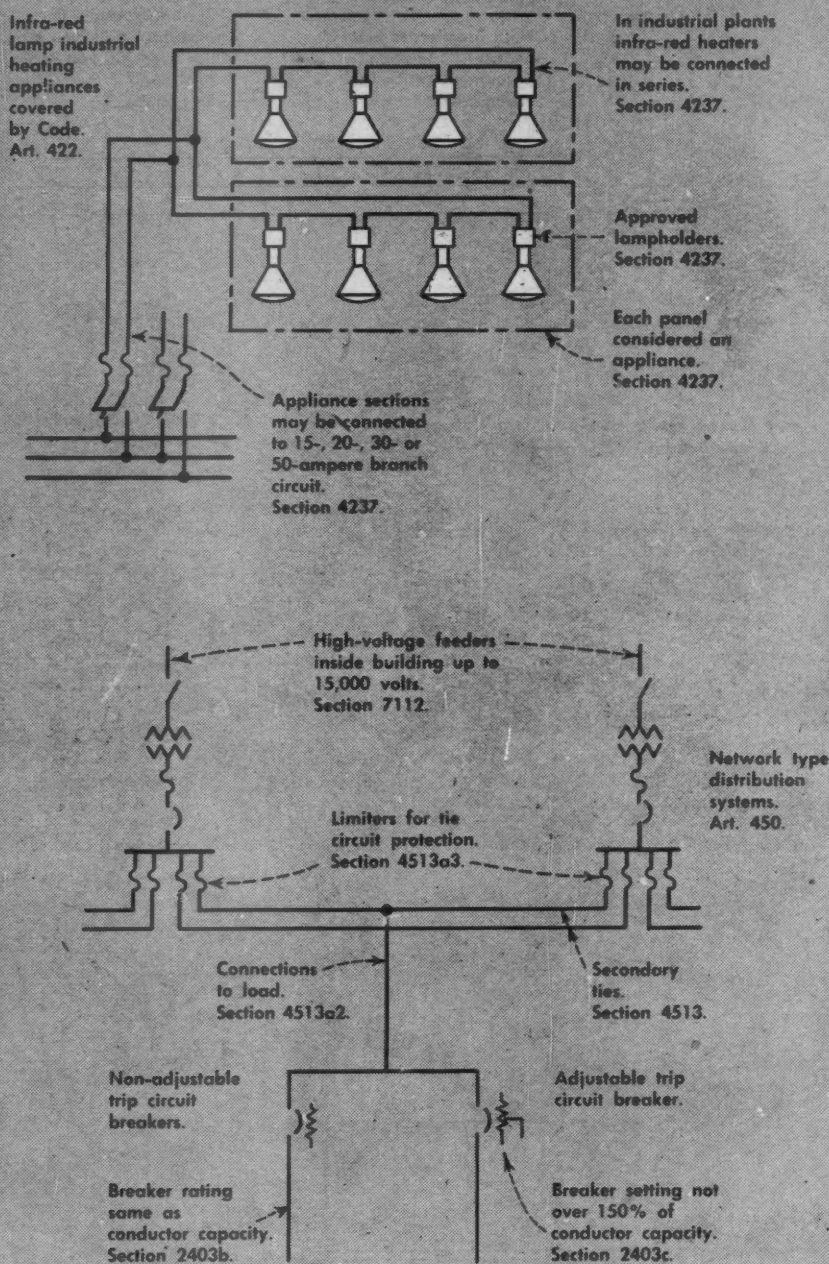


Fixture installation rules are expanded in the new Code.

develop in these wiring systems (section 2524). Heretofore, such supplementary grounding has been optional. The same purpose will be served by the new rule requiring the use of the same electrode for circuit and equipment grounding (section 2554). The ground-

ing of range frames has become mandatory and this may be accomplished by a connection from the frame to the neutral conductor, a practice which is now in widespread use (section 2560). A significant new approach to the problem of the protection of persons

Changes in residential wiring requirements in the new 1947 Code.



Changes affecting infra-red installation and network systems.

using washing machines is the requirement that the receptacle in the laundry be of the 3-pole type (section 2124b).

To provide complete protection against faults, circuit breakers protecting wiring systems must be equipped with an overcurrent trip unit in each hot leg (section 2405). Formerly it was permissible to use a breaker having two trip coils on a 3-phase 3-wire ungrounded system, except for services

where three trip coils have been required.

To provide safety for persons handling circuits of cartridge fuses, it is now required that each circuit have an independent disconnecting means (section 2440). The fuseholder or fuse-carrier type of switch should serve this purpose.

The text of the Code requires the use of type S fuseholders for plug fuse

installations, but a note following the text tells of a suspension of the mandatory provisions of this paragraph (section 2452).

Motor control provisions have been tightened. All automatically-started motors must have overcurrent protection for the motor (section 4322c). The 1940 rule applied to motors of $\frac{1}{8}$ hp. and up. Thermal units at motors may be set at 125 percent of the rating of motors of the 40 degrees C. open type only; all other types require protection not to exceed 115 percent of motor rating (section 4322a).

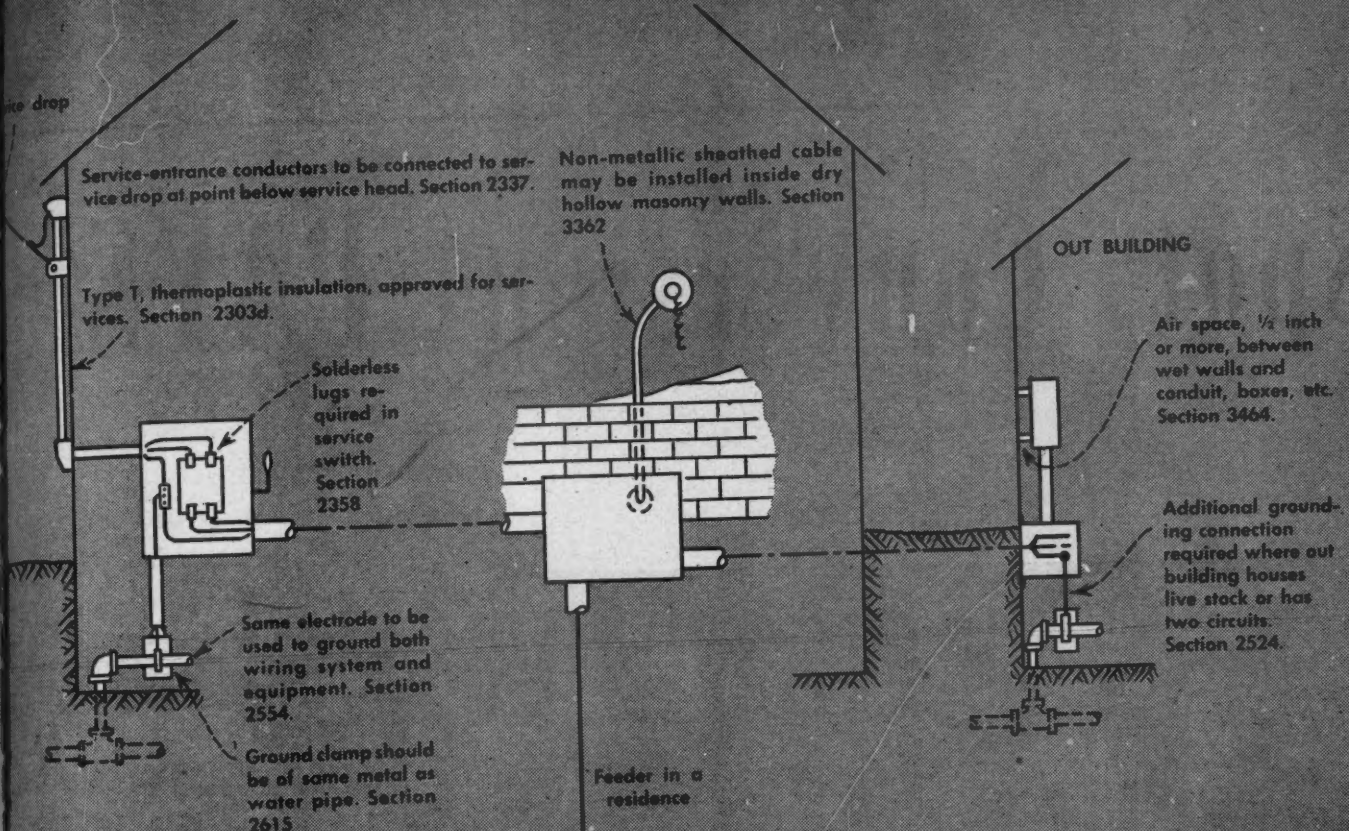
Motors which restart automatically shall not be installed in such a way that restarting can result in injury to persons (section 4333).

Capacitor circuits need excess capacity for harmonic currents and over-voltage allowances, and the requirement is that controls and conductors to capacitors — static condensers — have 135 percent of capacitor rating (section 4607). To avoid the damage which can result when too large a capacitor is hooked up to an individual motor, the Code will limit such capacitors to the value that will raise the no-load power factor of the motor to unity (section 4606).

Lighting fixture power factors are indirectly regulated by a ruling that where low power factor ballasts are to be installed, the circuit conductor capacity may need to be increased (section 2203a); and that when using the watts-per-square-foot tables of required capacity for buildings, loads of units which employ ballasts shall be based on the amperage of the units and not on the wattage of the lamps (section 2125b).

Conclusion

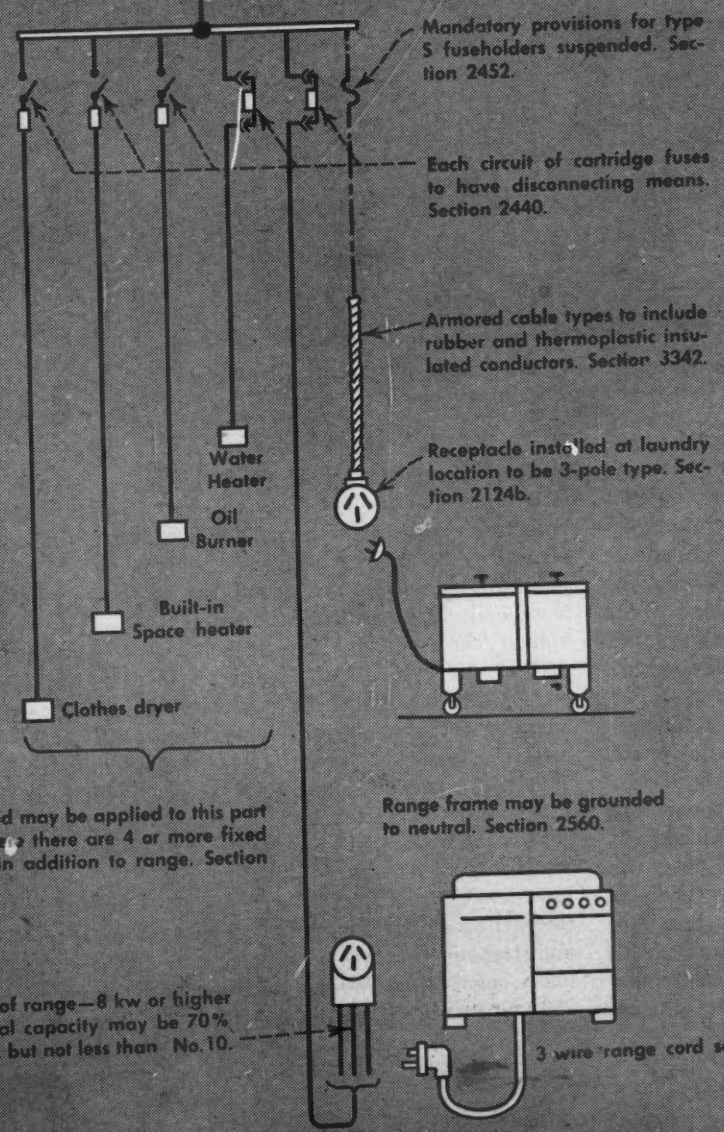
The enforced long lapse since the issuance of the last Code necessarily resulted in an accumulated need for revisions which was augmented by the rapid technical advance of wartime. How well this need was met in the 1947 Code remains to be tested in the field of experience. The National Electrical Code has provided good regulation for our industry and the public, and we may expect that the latest issue will continue to render fine service.



RATINGS
of rubber-covered
wire. Tables
1 and 2.

Type — R	RH	
	60	75
Size No.	Amperes	
14	15	15
12	20	20
10	30	30
8	40	45
6	55	65
4	70	85
etc.		

Nos. 14 and 12 type R and RH are now 'thin-wall' conductors having $\frac{2}{64}$ inch insulation. Section 93101f.



Computed load of range—8 kw or higher Table 29. Neutral capacity may be 70% of outside wires, but not less than No. 10. Section 2121C1.

Spot Conversion PAYS

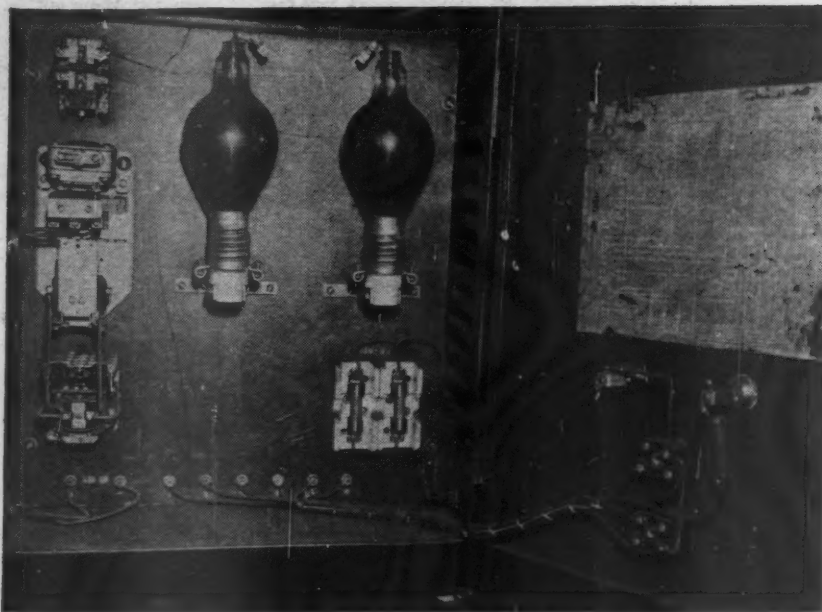


FIG. 1—Simple, compact rectifier, typical of those designed and built by Caterpillar engineers for spot conversion applications. This supplies d-c for a Hanchett grinder.

WARTIME shortages of spare parts and the difficulty of securing new motor-generator sets led the Caterpillar Tractor Co. to use electronic rectifiers for supplying necessary direct current for certain production machines. High line losses inherent in d-c transmission and the need for voltages of different magnitudes in a single area or on an individual machine resulted in the general shift to spot conversion throughout the plant. Now, obsolete motor-generator sets are gradually being replaced by rectifiers built to meet the exact requirements of individual production units.

Indicative of this trend is the rectifier application on a Hanchett grinder (Figs. 1 and 2). Here direct current

power is supplied by a unit which Caterpillar engineers designed and built to meet the precise load requirements of the magnetic chuck (holds parts to be ground). Two transformers were built, one to supply the filament voltage, the other for the plate voltage of two CE-215 electronic tubes (if proper core iron had been available, a single transformer could have been made). Other component parts of this simple unit include: One 50 watt, 460/115 volt standard transformer for the control circuit; a timer to prevent loading the rectifier until tube filaments have reached maximum temperature; a thermal overload relay to protect tubes and transformers; a three-pole, normally-open contact relay; a 6-ampere 250-volt fuse block; start-stop push but-

ton station and a red and green pilot light. Circuit diagram is shown in Fig. 3.

Operating Sequence

When the 440-volt a-c power feeding the machine is turned on, the rectifier control circuit transformer is energized (See Fig. 3). Pushing the start button energizes the three-pole relay which inserts the filament transformer in the circuit. Simultaneously the coil of the timer is energized (indicated by red pilot light). After a three-minute interval, to permit tubes to reach maximum temperature, the timer contact closes and energizes the plate circuit transformer (indicated by green light). The unit is now ready to supply full-

By

George E. Walters

*Electrical Maintenance Foreman
Caterpillar Tractor Co.
Peoria, Illinois*

Electronic rectifiers on individual machines effect dual savings through more efficient operation and reduced maintenance at "Caterpillar's" Peoria plant



FIG. 2—Operator "loads" magnetic table on Hanchett grinder prior to grinding operation. Rectifier in Fig. 1 supplies d-c to magnetize table.

wave rectified direct current to the magnetic chuck. No filter circuit was added to this specific unit since the quality of the output meets grinder chuck requirements.

Economic Advantages

Similar rectifiers have been used on several types of equipment with marked decrease in maintenance cost. One

specific case was a special lathe requiring both 110- and 16-volt d-c service. Formerly a dual-voltage, double commutator, motor-generator set served this unit. With two windings (one wound over the other) in the same slots of the armature, a burnout in one usually meant replacing both. Such high maintenance cost is now eliminated.

Contrasted with the relatively high

maintenance cost of motor-generator units, frequent inspection, cleaning and adjustment, lubrication and inherent wear, electronic rectifiers should give many years of low maintenance service. They have no moving parts and, except for tube replacement, are trouble-free. If a few simple precautions are taken, dust and other foreign particles have no effect upon them.

Operating economies are also effected. When motor-generator sets are running at no load, the efficiency of the a-c motor is practically zero; the power factor of the a-c circuit low. Whether operating at no-load or full-load, the rectifier has no effect on the power factor and tests have indicated an efficiency of 75 to 80 per cent.

Our experience with electronic rectifiers has demonstrated their dependability when properly built to fit specific machine requirements. Although the major part of the initial cost involved labor for building the transformers, this could be materially lowered if — and when — standard transformers are available to supply the various voltages needed at the machine. Taking all costs—initial and operating—into consideration, we find that spot conversion is the most economical method of securing direct current service for most individual machine requirements.

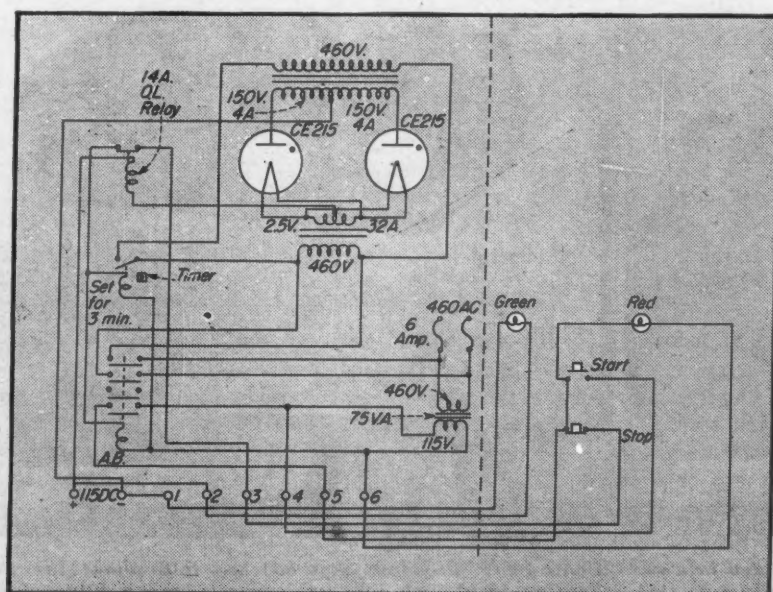


FIG. 3—Circuit diagram of rectifier shown in Fig. 1.

Lighting Program FOR CONTRACTORS

Developed to stimulate greater interest in the huge sales lighting market, the NECA-G.E. coordinated Sales Lighting Program is sharpening contractor activity, producing better designs and layouts, and increasing unit sales.

By Berlon C. Cooper

FIFTY-THREE electrical contractors, and some 20 other lighting men gathered in the Hotel Rodney's conference room at Wilmington, Delaware one October morning. At 9:30 A. M., K. C. Larabee, Continental Lamp Division of the General Electric Company, Philadelphia, briefly outlined the contractors' opportunity in lighting sales. By 4:30 P. M., we had heard two engineers present verbally, and with the use of charts, moving pictures and slide films, and a demonstration of newly developed and popular type light sources, a hard-hitting six-point Lighting Sales and Service program for electrical con-

tractors. The group, enthusiastic to a man, then dispersed and returned to the towns and villages of Delaware and the Del-Mar-Va peninsula from which they had come, each anxious to be the first to put this program into operation in his own community. It was the 93rd in a series of similar meetings held nationally.

This coordinated program is being presented rapidly to contractors in all major localities throughout the country. The Delaware meeting is typical. Enthusiasm of contractors is running high, as attested by comments of many of those at the Delaware meeting, and by hundreds of letters written to the

sponsors by contractors who have attended other meetings. Developed specifically for electrical contractors, the program covers the entire field of store lighting.

The major objective of this program is to develop a more intelligent and wider use of lighting in the commercial store lighting field, and to train electrical contractors and their sales organizations how to plan and sell better planned lighting installations which store owners want and need. It is a practical program, carefully planned step by step. It originated under the sponsorship of members of the Greater Cleveland Chapter of the National Electrical Contractors Association in cooperation with General Electric officials. Practical suggestions of the contractors were combined with the technical know-how and tried and tested sales promotion techniques of the lamp manufacturer. These form the basis for the program, which has been operating in the Cleveland area for more than a year. It is now available to all contractors large or small, NECA members and non-members alike.



Today's store lighting challenge is here presented in a six-point program to electrical contractors at Wilmington, Del., by Frank Hutter, Lamp Department representative from General Electric Company's Philadelphia office.



Contractors attending sessions are told about the new lighting tools, including light sources and lighting equipment, by A. S. "Scotty" Turner, also representing the Philadelphia branch of the G.E. Lamp Department.

FOR TRAINING SALESMEN

1. "Seeing is the Biggest Thing in Selling." This is a 16 mm. sound movie film in color. It shows the value of lighting in selling merchandise. This film is available for showing to industry groups, also for merchant or civic groups.
2. "The Magic of Fluorescence." Another 16 mm. colored sound movie film which shows pictorially how the fluorescent lamp is made and how it works. This film is available for group showings.
3. La Salle Store Lighting Sales Training Course. This is a comprehensive training course on the fundamentals of lighting, installation, and principles of sound salesmanship. It was prepared jointly by General Electric Company Lamp Department and LaSalle Extension University. The course consists of five bound texts, examination, etc.
4. "The Three A's of Store Lighting." A store lighting handbook, fully illustrated with photographs and sketches, showing "How to do it" ideas.

FOR USE WITH CUSTOMERS

1. "Lighting That Moves Merchandise." A sound slide film which explains the 1-3-5-10 Store Lighting formula that produces three-A lighting (atmosphere, attraction and appraisal). This film is available for use with store owners locally.
2. "Seeing is the Biggest Thing in Selling." This is a 40-page booklet which tells in printed form the story given in the color film having the same title.
3. "Store Lighting Layout and Design Guide." This is a six-page simplified recommendation form, which enables an untrained lighting man to prepare a lighting layout for the average small store.
4. "Planned Lighting Pays." A leaflet for salesman's use with a store owner. The cost of an existing lighting installation can be compared with the cost of a recommended installation made on the form above.
5. "Planned Sales Lighting = Profits. Poor Lighting = Losses." This 16-page booklet describes and explains the 1-3-5-10 planned lighting formula for the store owner.
6. The Store Lighting Visualizer. This is an 8x11 inch easel containing 38 pages of full color pictures. It sells the merchant on the things that are shown in the film and booklet, "Seeing is the Biggest Thing in Selling."
7. "A Business Future for You." This booklet covers planned lighting maintenance service. It describes three types of maintenance Contract Forms which are available, a personalized 3-piece direct-mail campaign for solicitation of maintenance service, an assortment of six envelope enclosures, and other Certified Lighting Service material.

Following the successful testing of this program in Cleveland, it was expanded and prepared for broad presentation to other contractors on a national scale. It was recognized that contractors as a group represent the most potent sales force in the lighting industry. They face an entirely new kind of market, one that has never existed before. This market must be served quickly, with a minimum of manpower. The demand for better lighting is great, and the market should not be undersold. Local contractors are already in contact with these merchants, in business, in civic enterprises, and in social life. To serve this market most effectively and profitably for contractors and their customers alike, will require new sales and installation tools, new promotional and educational techniques. It was around these factors that the Store Sales Lighting Plan for Electrical Contractors was developed.

The basic plan for presenting the program in any one locality is to schedule a series of four two-hour meetings, each on different convenient

dates. In some localities the program has been condensed into one meeting, usually an all-day session as was the case at Wilmington. Meetings have been held in over one hundred cities. Other meetings are scheduled and now in progress in other areas.

The Program

The coordinated Store Sales Lighting Plan is being presented to the contractors by representatives of district sales and service divisions of the lamp department, General Electric Company. All contractors in a local area are invited to attend and participate in the meeting, held centrally in that area. During the meeting, facts and figures are given about 1) the great store modernization activity, 2) the part that modern sales lighting plays in store modernization and new stores, 3) promotional activities which will stimulate the demand for better store lighting, 4) profit possibilities in store lighting sales and service, 5) the how and why of figuring planned lighting installations, and 6) how to

capitalize on this great new lighting business opportunity available to electrical contractors.

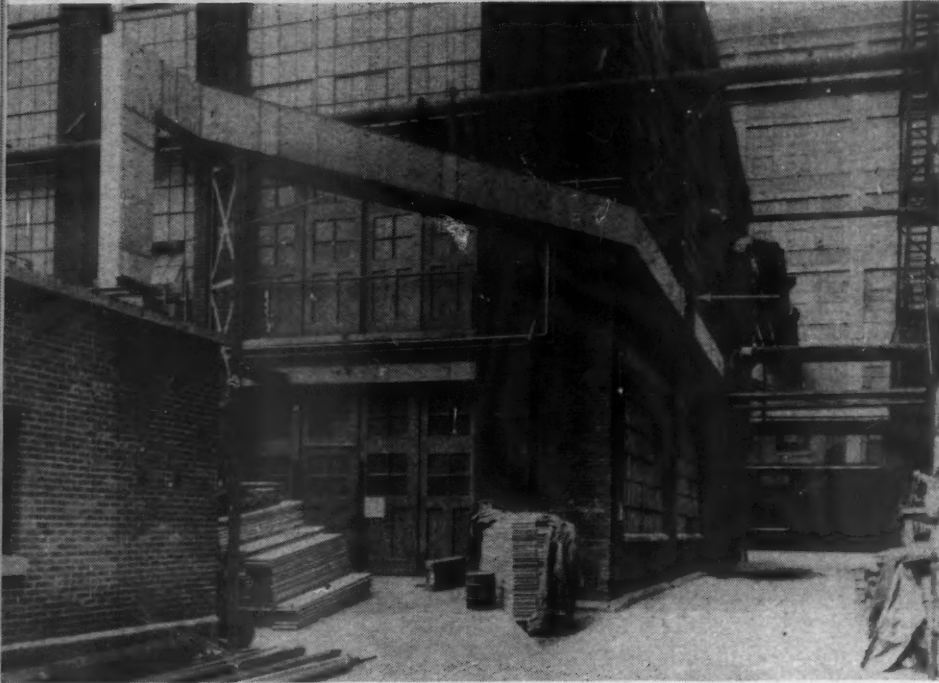
Part of the program is devoted to stimulation of greater contractor interest in the unprecedented lighting market ahead, with its resulting profits and local prestige. Other parts are educational, tell the contractor or his salesmen about the lighting and sales tools available and the proper lighting techniques for stores with their wide variety of lighting problems. Some very brief highlights of the program are given below.

The Market—There are now over 1,300,000 retail establishments in the United States, some 400,000 less than in 1939. Surveys indicate that eight out of ten retail merchants want to improve their window and interior lighting. Contractors are told that 80 percent of the stores listed in their telephone directory will spend on the average of \$1500 each for modern sales lighting. This is a ready market which can, and should, be sold fast. The number of stores of the eight major

[Continued on page 132]

Scrambled Phase

Compact split-phase configuration of busbars and fibrous-glass insulation are features of weatherproofed 4000-ampere low-loss feeder installation.

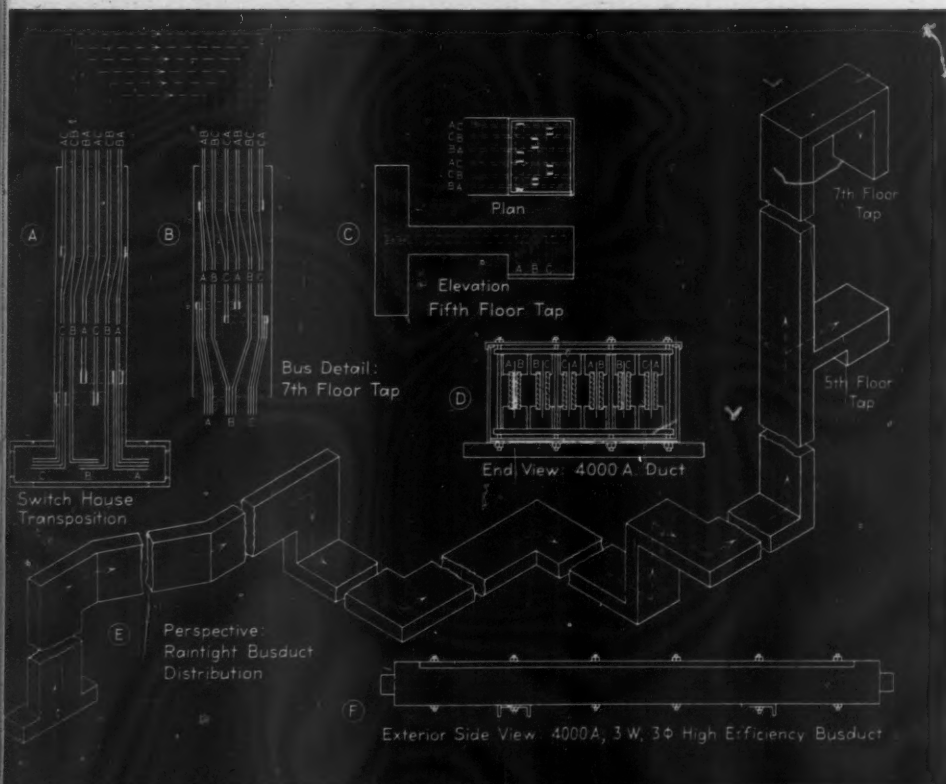


Weatherproofed duct work rises through roof of new switch house (left foreground) and crosses diagonally to exterior wall of building. Duct is constructed on edge with cover on side to permit passage through narrow 12 inch clearance gap (arrow) between building and vertically rising steam pipes.

HIGH efficiency weatherproofed busduct has effected tangible reductions in voltage drop, heat losses, cross sectional area requirements for current-carrying copper and installation costs of a new 4000-ampere distribution system now serving the Carrier Corporation's manufacturing plant at Syracuse, N. Y. Exterior routing has permitted the erection of long, uninterrupted duct runs between the main service entrance and remote areas requiring added capacity, and the use of fibreglass insulation between adjacent bars of coupled, split-phase conductors has reduced protective air gaps and resultant duct areas well below former standards.

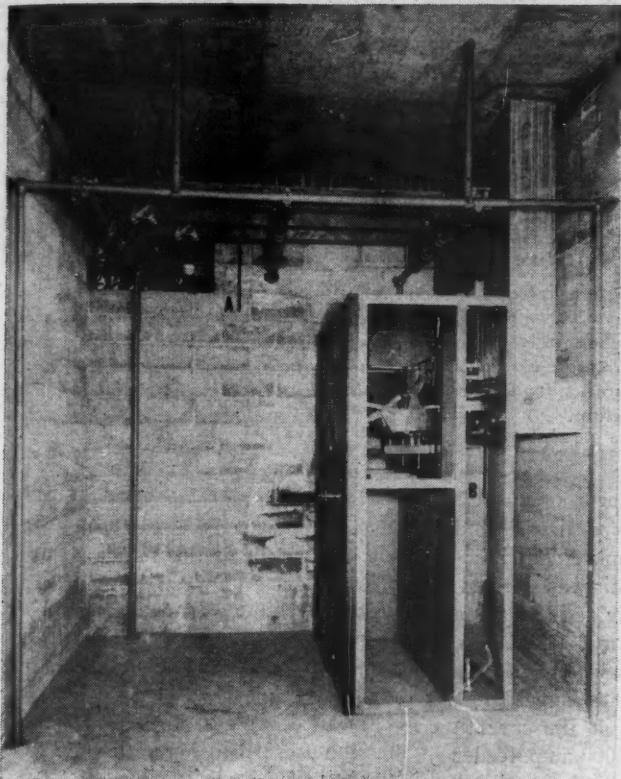
With increased postwar demands for domestic and commercial air conditioning units, refrigeration assemblies, condensers, humidifiers and heat interchangers; projected curves of production predicted the inadequacy of the existent electrical distribution system and stressed the necessity for augmenting feeder service to the fifth and seventh floors in the assembly building. It was considered impractical to bring additional feeders from the switch house to these two areas through the main plant due to the reinforced concrete construction of the buildings which would have involved major routing and channeling problems, and the multiplicity of existing pipe lines and electrical branches serving installed machinery. It was apparent that routing the additional service around the exterior of the buildings would mini-

Transposition sections at switch house (A) and seventh floor terminal (B) scramble and unscramble phases. Fifth floor tap (C) is for future use and is capped at present with ebonized asbestos seal. End view of 4000-amp. busduct indicates arrangement of conductors, fibreglass insulation and cover holding bolts. (D). Standard sections (F) were augmented by special construction to permit erection of weatherproofed system (E). (Dwg. 1)



Transmission

By Hugh P. Scott



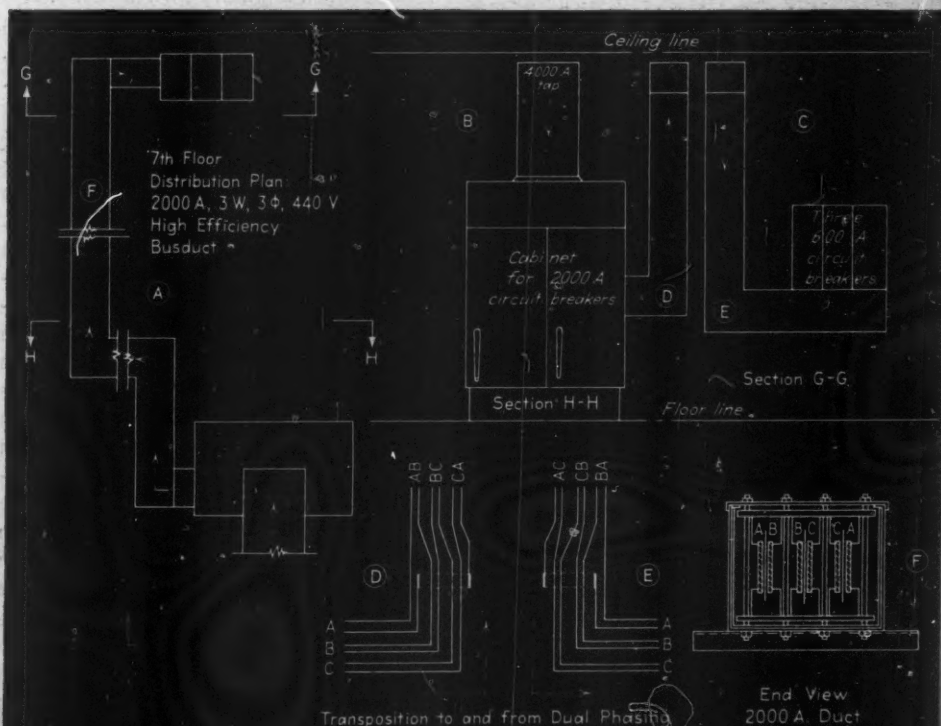
TOP LEFT—Stepped from 11,000 volts to 440 volts in the main transformer and switch house; 3 phase, 3 wire current is brought into auxiliary switch house through twelve 5 by 1/4 inch busbars (A). After passing through 4000 amp. breaker, current feeds to transposition section (B) of weatherproofed, high efficiency bus distribution system.

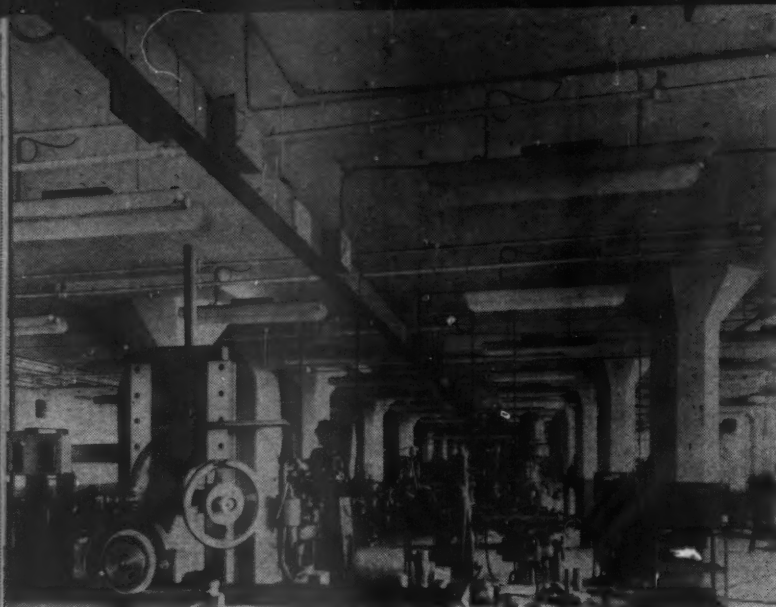
TOP RIGHT—After passing between building and pipes, duct work is stepped downwards at a right angle to take advantage of the I-beam support which holds existing pipe cradle. In transition, the duct covers are placed on top of the housings. Weatherproofed feature is achieved by gaskets.

minimize structural alterations, erection difficulties, lengths of runs, demand for critical materials and labor.

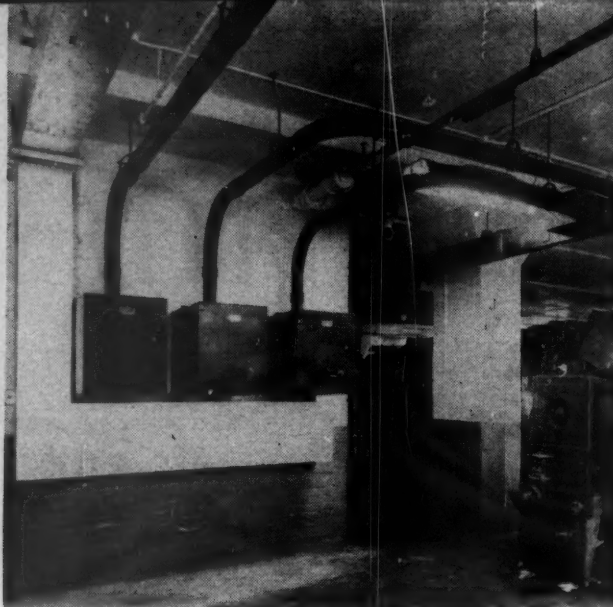
Extensive economic and efficiency studies of various cable-conduit and busduct distribution systems were made cooperatively by Hillebrand and Owen, Syracuse electrical contracting organization selected to install this additional service, and by Robert Petrusek, electrical engineer for the Carrier Corporation. These conjunctural studies included attention to the annual cost of transmission losses as well as to amortization charges credited to materials and labor. The studies indicated that a low loss busduct installation would combine reliability of

High efficiency busduct is installed across the ceiling of the seventh floor between the 2000-amp. breaker cabinet (B), at the top of the exterior duct work, and the three 600-amp. breakers (C) that protect the distributing plug-in busways. Transposition sections (D and E) are included at either end of the 277-foot installation (A). Cross sectional view (F) shows mounting arrangement of bars and glass insulation. (Dwg. 2)

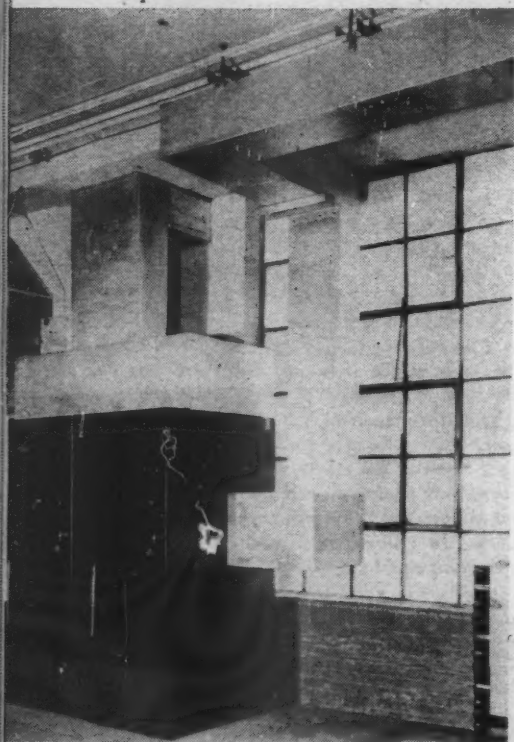




Steel pendants and inverted stirrup hangers suspend plug-in bus duct system from ceiling of manufacturing plant. Conveniently spaced power outlets offer flexible connection locations for short branch feeders to machines. Rubber covered flexible leads eliminate possibility of vibrations creating short circuits.



High efficiency system terminates in L-shaped section beneath three 600 amp. breaker cabinets. Unscrambled phases are connected to breakers through connecting links that protrude upwards through insulating ebony panel. Cable conduit feeders connect with plug-in bus duct distributing system.



Seventh floor distribution system begins at top of 4000 amp. weatherproofed exterior riser. Terminal circuit breaker cabinet has provision for serving two 2000 amp. sub-circuits although only one is connected at the present time. Interior 2000 amp. high efficiency busway has covers on bottom to permit snug ceiling mounting with maximum floor clearance.

service and provision for future expansion with ready accessibility, reduced maintenance, a high power factor, negligible voltage drop and minimized requirements for both current-carrying copper and protective

steel housings. Weatherproofed, high efficiency bus duct as designed and constructed by the Frank Adam Electric Company of St. Louis was selected.

The duct system is divided into three components; an exterior 4000 ampere run with a tap for future use at the fifth floor and twin 2000 ampere terminal circuit breakers at the seventh floor level, an interior 2000 amp. feeder busway across the seventh floor ceiling, and three 600 amp. distribution plug-in bus ducts protected by breakers of rated circuit capacity.

Transformed from a primary service of 11,000 volts to the distribution level of 440 volts; three phase, three wire current is tapped in the main switch station and conducted directly into an adjacent, newly erected, brick and concrete block auxiliary switch house. Delivered through twelve $\frac{1}{4}$ by 5 inch copper conductors (4 bars per phase), the current passes through a 4000-amp. circuit breaker to the first section of weatherproofed duct. (Top left—page 53.)

In this first section, transposition rearranges the 12 conductors into six split phase pairs of bars, two pair each of phasing A-B, B-C and C-A. Interleaving the parallel high capacity bus-bars is in accordance with the research demonstrated fact that this practice, in close proximity, substantially minimizes line reactance. Research also has proved that better current distribution is achieved through combining electrical skin and proximity effects.

These bars, with continuous $\frac{1}{2}$ inch thicknesses of fibrous glass insulation separating each split phase pair, are

held by insulating mounting brackets (Dwg. 1-D) spaced at 20 inch intervals along the length of the standard, pre-fabricated ducts (Dwg. 1-F). In addition to regrouping bar arrangement, transposition also alters bus widths to 4 inches although thicknesses are maintained at $\frac{1}{4}$ inch.

Use of fiberglass insulation eliminates the prescribed separating air gap between bars of unlike phase and permits maximum compactness of conductor arrangement, reducing the required cross-sectional duct area by over 50 percent and insuring minimum voltage drop due to close configuration of bars.

The use of fibrous glass electrical insulation is especially well adapted to weatherproofed high efficiency busways according to a study by the manufacturers. It is affected to a lesser degree than other conventional insulations by moisture and it withstands attacks by corrosive vapors, oils and acids. Woven glass has twice the voltage resistance of asbestos, and has greater structural stamina to withstand vibration. Being non-inflammable, high in tensile strength, flexible and inorganic are additional benefits.

Standard 4000 amp. duct sections of 14 gage galvanized steel measure 10 feet in length, $24\frac{1}{2}$ inches in width and 11 inches in depth. With enclosed bars and accessories in place, each section weighs 900 pounds. Series of bolts, spaced not more than 20 inches apart, pass completely through the sections to hold the continuous cover and bus-supporting insulating mountings firmly in position. Each sectional cover con-

[Continued on Page 129]

BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods

Lacquer Film Protects Castings

INDUSTRIAL

In many industrial plants, castings are stored in outdoor stock areas until such time as they are needed in the machining or assembly departments. Rust inevitably accumulates on these unprotected surfaces, necessitating an extra operation for sand blasting the parts prior to use.

The Star Electric Motor Company of Bloomfield, N. J., has solved this problem by dipping all castings in a lacquer vat before storing on stock shelves located in a roofed but otherwise unprotected shed. The accompanying photograph, showing sets of undipped and dipped motor end caps after four months of storage on these shelves, indicates the heavy accumulation of iron oxide on the unprotected surfaces and the preserved condition of the lacquered castings. On removing the castings from stock for use in the plant, local treatment with a lacquer solvent permits machining without gumming or heating the high speed tools in the machining department.



After four months storage in a semi-open stock area, lacquered cast iron motor end caps (right) are found to be in excellent condition while untreated caps are thickly encrusted with rust and must be sand blasted before machining is feasible.

Automatic Welding Retreads Wheels

INDUSTRIAL

Due to the shortage of critical materials during the past few years, many industries developed substitutes which, though born of necessity, will continue to be used due to their proven equality or superiority to the materials they replaced. Inventive maintenance techniques were also developed whereby the life of old equipment was materially increased and minor repairs made major replacements unnecessary. An example is the "retreading" of iron wheels of mine locomotives. The steel center of Pittsburgh saw many cases where 200-pound wheels were scrapped, due to wearing of the rims, before the development of automatic welding.

Automatic electric welding, employed at the Homewood Westinghouse plant, built up the lip of the wheel. A running bead of weld is applied to the slowly revolving wheel and pre-set electrodes permit the weld material to flow evenly to the wheel. Subsequently milling reduces the surfaces



Automatic electric welding operation builds up worn tread of mine locomotive wheel. Subsequent milling reduces surface to true diameter. An annual saving of a million pounds of steel was recorded by the Westinghouse Homewood plant in Pittsburgh.

to conform with the original diameter. Seldom was it necessary to utilize more than 50 pounds of weld to salvage a 200-pound wheel and mileage records indicated that the additional use nearly duplicated the original life. The application of this method in the Homewood plant resulted in an annual conservation of a million pounds of steel and its logical continuance suggests the creation of additional plants whereby other sections of the country can benefit.

Compass Locates Shorts

WIRING

A small pocket compass, a six volt battery and a resistor aids Judson Cogger at Palo Alto, Calif., in locating the exact position of shorts in portable cords. The method has proven accurate, rapid and inexpensive.

In operation, the battery and resistor are connected in series with leads tapping the wires of the cable to be tested. Approximately 10 amps. are maintained in the leads. The compass is then moved slowly along the length of the cable, starting at the lead connections and progressing away from

ILLINOIS PORCELAIN WIREHOLDER INSULATORS

Insure
SAFE
HOUSE SERVICE
CONNECTIONS..

• When you use Wireholder Insulators with the name "ILLINOIS" you are backing up your work with the right quality for the job.

All corners are rounded to prevent injury to the insulation of the wires. The screws have deep, sharp threads for easy installation. The screws are fastened into the insulators with non-shrinking metal alloy. The all-steel screws are hot galvanized by a special process to insure a smooth, even coating. Will not cause rust streaks on the sides of buildings. These dry process wireholders are made in sufficient styles and sizes to meet all requirements. Wet process porcelain supplied on special order.

OUTLET BOXES



Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

ALL-PORCELAIN ILLINOIS SYSTEMS



SWITCH BOXES

Insure greater safety in wiring and the elimination of all grounding hazards. Made of the best quality of white porcelain. Metal inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plug outlets, etc. Knockouts for single wires, also for cables. Specify and use them.

*for
outstanding, adequate and
modern wiring jobs*



KNOBS

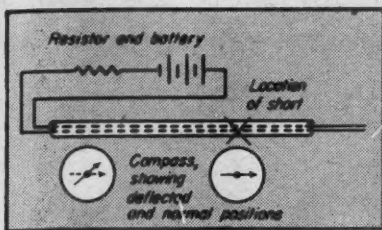
Cement coated — extra length nail—genuine leather washer — code standard. They don't chip when driven in and they do stay in place and have a firm grip. Available in a wide variety of heights, diameters, holes, and grooves.

STANDARD TUBES

in sizes 1/2 to 48 inches, 5/16 to 3 inches diameter in following types: unglazed, glazed, split, floor split floor, headless, curved and, crossover split, and cross over. Diameters all uniform both inside and outside.



ILLINOIS ELECTRIC PORCELAIN COMPANY *Macomb, Illinois*



Battery and resistor are connected in series with conductor suspected of being shorted. A small compass is passed along the cable, slowly moving away from the connecting leads. Induced magnetism deflects the needle until the location of the short has been reached, at which point the needle returns to its normal position.

them. The induced current in the cable is sufficient to divert the needle of the compass from its normal position and this deflection remains fairly constant until the location of the short is reached. At this point the needle becomes unaffected and will swing back to the original azimuth. Watching the needle, the point at where it swings to normal is marked and the short has been spotted.

Perpetual Files Cut Guesswork

INDUSTRIAL

The maintenance of complete records and properly cross-referenced files is vital to accuracy in modern offices and organized shops where numerous jobs are in varying stages of completion, customer or government inquiries for information must be satisfied and estimates of future demands, predicted on past consumptions, require specific data too exacting for memory. Even granting that all pertinent information could be retained in the minds of some few members of an organization, records and files still remain a safeguard against the possible absence of these persons. When designed for easy comprehension and constantly maintained in an accurate condition, files and records become the brains of an office.

The Everson Electric Company of Allentown, Pa., operating separate shops for repairing motors and for winding coils, gives due credit to their filing system for maintaining office efficiency, insuring adequate stocks and furthering customer good will. Since the size and scope of their stock room makes frequent visual inspection impractical, a perpetual Kardex inventory became a necessity. Now stock volumes are instantly apparent and the retention of these levels becomes automatic.

Individual cards are maintained for every item used in either shop; wire, tape, mica, sleeving, pressboard, shellac, soldering salts, drab and associated materials. Items are sub-classified so that, for example, stocks of wire are stored and listed as round, square or rectangular; cotton, glass or asbestos insulated; by number or thickness. Two adjacent files contain Order and Disbursement Cards. Stock numbers permit quick cross reference, making the complete status of any item immediately apparent.

Order cards list vendors, discounts, account numbers, units of volume by which replacements are ordered (100 lbs., 50 gals., 1000 ft.) and minimum stock levels to be maintained. Minimum levels are determined by the popularity of the item, frequency of use, average quantities used for typical jobs and the length of time required for delivery. Past consumptions are listed by months so that estimates of expected maximum and minimum requirements are founded upon facts. The most important information listed pertains to the actual orders; date, vendor, order number, quantity specified and promised date of delivery. When delivery is received, the card is marked with the date of receipt, exact quantity, balance due and unit cost.

Disbursement cards indicate balances of materials, dates and quantities of all withdrawals, requisition numbers and future commitments. When a commitment has been made to perform a job, the estimated amounts required for that job are recorded in red, indicating that material in stock is ear-marked for a specific job and is unavailable for other

DISBURSEMENT CARD FOR No. 16 Formex									
ORDERED					RECEIVED				
DATE	ORDER NO.	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7
8/1	1000	500	10/7	500	10/7	500	10/7	500	10/7

Disbursement card for No. 16 Formex wire indicates dates, requisition numbers, quantities used and perpetual balance. When ear-marked quantity (8/4) brought balance below safety limit (300 lbs.), order was placed with vendor No. 1 (G. E.). As deliveries were made (10/7 and 11/6), and as material was used, balance was altered accordingly.

orders. When the material is finally used, the red estimated consumption is ruled out and the exact consumption entered in black. Whenever a balance falls below the desired minimum level (due to either using or ear-marking material), an order is immediately issued so that the level will be brought up to the safety point.

The value of this system is attested by the fact that, although faced by material scarcities and delayed deliveries, at no time has it been necessary to delay an order due to a lack of material. Keeping an eye on the record allows Everson to satisfy customers, keep a full complement of repair crews at work and safeguard—without glutting—stock levels.

Data for maintaining these cards is supplied by a stockroom supervisor who is charged with filling out Material Forms. Material forms carry the complete story of orders from the time of receipt, through progressive shop steps to delivery and billing. Any question pertaining to an order, including information obtained from customer, salesman or repair crew, computations of quantities and time tickets for billing purposes; can be answered in the brief time required to open a file and withdraw a customer's folder.

Perpetual inventory and material forms require only a few minutes to fill and file. An accurate story is available at all times, ordering of stock and prompt billing becomes automatic, guesswork is eliminated and customer confidence is strengthened.

Pivot Drive For Shop Lathe

EQUIPMENT

When Wayne Electric Company, Fort Wayne, Ind. motor service shop, decided to motorize a 16-in. Hendey lathe they designed what they call a pivot or floating drive. Installation is such that the complete drive can be removed by merely loosening two set screws.

The unit (Fig. 1) consists of a 2 hp., 3-phase, 1200 rpm., 220 volt motor mounted to a sheet steel platform. Through a V-belt connection, the motor drives a step-pulley jack shaft (19-in. dia. sheave) on ball bearing pillow blocks mounted to the front of the motor base. Welded to the back of the lathe bed and supporting the complete assembly is a 30-inch length of 3-inch pipe tapered slightly at the top to receive a 3-in. coupling, also bored out for a snug fit. A round steel



Heat foiled again

and again

and again

and again



The switch mechanism in the new Cutler-Hammer line of safety switches is designed to withstand safely any degree of heat that can be expected from correctly selected fuses.

Because of this advantage and because of the greater ease of installation and convenience of operation, because of proved performance and attractive appearance, Cutler-Hammer wholesalers and more and more alert contractors from coast to coast feature and recommend these outstanding switches. ...CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

*By the
New*



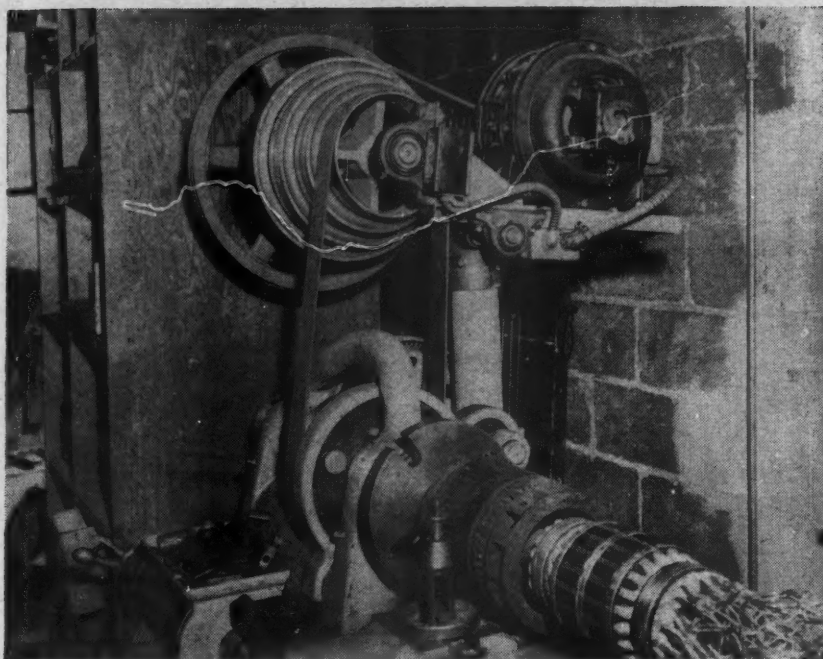


FIG. 1—Compact pivot drive for shop lathe is so designed that weight of motor portion provides necessary tension on belt between jack shaft and lathe. Pushbutton on jack shaft support is for normal operation.

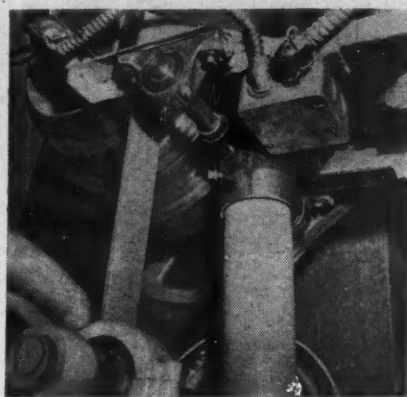


FIG. 2—Detail of pedestal mounting. Complete assembly pivots on shaft in collar welded to coupling which rests on pipe pedestal. Set screws (arrow) lock unit securely in place.

shaft, mounted to the motor base by ball bearing pillow blocks and to the coupling by a welded collar, "hinges" the drive unit to the pedestal. Two set screws in the 3-inch collar locks it securely in place (Fig. 2, arrow).

Belt tension between the jack shaft and lathe pulleys is provided by the pivot mounting of the motor drive. The design is such that the weight of the motor behind the pivotal shaft is slightly more than the jack shaft in front. When the operator wants to change lathe speed, he merely pulls down slightly on the jack shaft, shifts the belt and releases his hold.

Dual motor control is provided so the lathe can be used as an armature banding unit. While performing ordinary machining operations, the operator stands in front and uses the push-

button control mounted to the jack shaft support (See Fig. 1). For the banding operation, he stands behind the lathe and uses a foot switch so both hands can be free to guide the banding wire on the armature. The motor control system is shown in Figure 3. It consists of the pushbutton mentioned before; a magnetic switch (1); a duplex outlet with a single receptacle and a double-throw toggle switch (2); and the foot switch with flexible cord and plug (3). With the toggle switch either the pushbutton or the foot switch can be placed in the circuit.

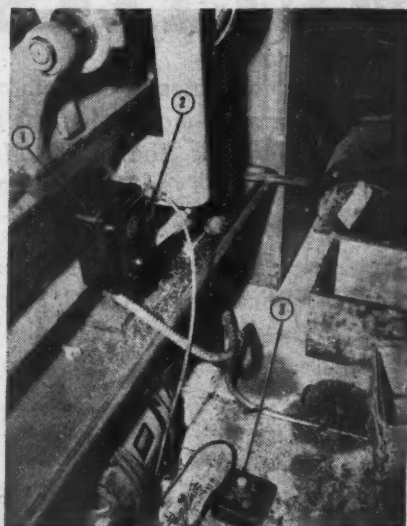
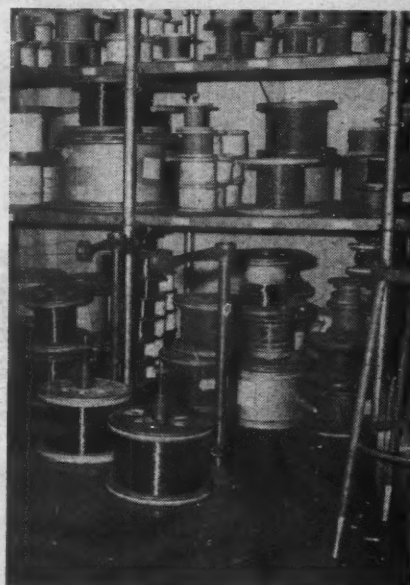


FIG. 3—Elements of dual electrical control are magnetic switch (1); plug receptacle and double-throw toggle switch (2); and foot switch (3). Toggle switch places either pushbutton hand control or foot control in the circuit.

Economy and Speed In Use of U Bolts

INDUSTRIAL

Threaded pipe flanges with holes punched to receive the legs of U bolts are used in several ways in the motor repair shop and stock area of the New England Machine and Electric Company, Pawtucket, R. I. Screwed to the floors, they form rigid, sturdy bases to receive pipe uprights. Between uprights, shorter sections of pipe, fitted at either end with these threaded flanges, are fastened by means of U



bolts. Stock shelving is erected on horizontal pipe sections, threaded at both ends and fitted with flanges which are punched to receive legs of U-bolts. The U bolts, passing around vertical pipes, are snugged into place by lock nuts. Vertical pipes are securely fastened to floor by means of screws through flange holes. Shelves may be quickly changed for elevation, material is re-useable and labor is saved in erection of framework.

The bolts are passed around the vertical pipe members and the legs are inserted through the flange holes. Locknuts on the protruding legs insure a snug connection. The resultant framework of vertical and horizontal pipe members lends support to stock shelving comprising planks placed over the horizontal pipes. The shelves are readily adjustable for height, the materials used are completely salvagable, the stock area is neat in appearance and the area may be quickly disassembled and moved if required.

Another use for the flanges and U bolts is in the construction of reel racks to hold heavy cable reels. Horizontal, vertical or inclined pipe members are fastened to one another by threading the end of a pipe.

FEDERAL Type MO 4



2 way Circuit Protection

Thermal
Magnetic



Write for Bulletin No. 154

MULTI-BREAKER

Magnetic trip operates in a fiftieth of a second or faster, even on minor shorts. Thermal bi-metal element provides time-delayed tripping on moderate overloads. That's *THERMAL-MAGNETIC* Protection . . . built into Federal's new Type M04—the smallest, lowest-priced, most efficient Multi-breaker ever produced.

● 4-pole range ● For flush or surface mounting ● Only 5 1/16" x 7 3/16" x 2 7/8" ● Wire ratings 15, 20, 30 amp. ● Ideal wherever two lighting or appliance circuits and a small electric range circuit are needed . . . or where four lighting or appliance branch circuits are needed.

FEDERAL ELECTRIC PRODUCTS COMPANY—Executive Offices: 50 Paris Street, Newark 5, New Jersey. Plants: Hartford, Connecticut; Newark, New Jersey; St. Louis, Missouri.

Federal NOARK

INDUSTRIAL CONTROLS

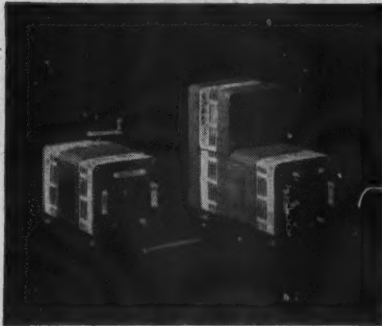
FEDERAL ELECTRIC PRODUCTS COMPANY, MANUFACTURERS OF A COMPLETE LINE OF ELECTRICAL PRODUCTS INCLUDING: MOTOR CONTROLS, SAFETY SWITCHES, CIRCUIT BREAKERS, SERVICE EQUIPMENT, PANELBOARDS AND SWITCHBOARDS

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising department, tell them in what issue of **ELECTRICAL CONTRACTING** you saw the item and they will send full details to you.

Equipment News

Induction Voltage Regulators

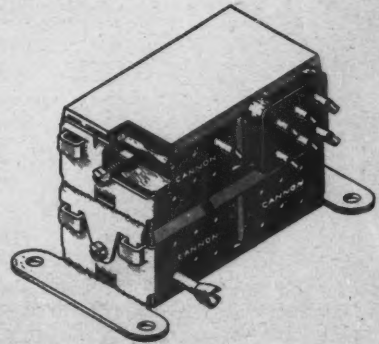
Announcement of an extended line of dry type induction voltage regulators to include 300 and 600 volt ampere ratings has been made. Originally developed for use in communication equipment, the new inductrols are available in two designs; hand or motor operated for providing a variable output voltage from a relatively constant supply voltage; and automatic for maintaining closely regulated output voltage from a varying supply voltage. Typical applications of inductrols include motor speed control, heat control of electric furnaces, illumination control, rectifier control, dielectric testing and instrument calibrating. They are designed for continuous operation with a temperature rise not to exceed 55 C. Control is provided by a voltage regulating relay that responds to changes in the load voltage and actuates the operating motor through a motor-control relay. General Electric Company, Schenectady 5, N. Y.



G-E REGULATOR

Terminal Block

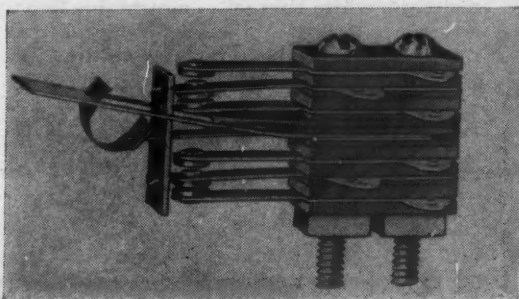
The new Type "Y6", multiple to single disconnect, is a flexible but compact terminal disconnect device for aircraft, radio and other equipment carrying many low amperage circuits. The basic unit is built with foot brackets, having two mounting holes each, and six socket contact block, and is designated Y6-1F-1H. From this basic unit additional units may be added, both vertically and horizontally, with side brackets and extra top interlocking strips. Both sides of the block are identical and may be plugged in on either side with the six-contact plug, or a single contact. The contacts are brass, silver-plated and accommodate No. 16 AWG wire for 5 amp. circuits. Contacts may be bussed. Cannon Electric Development Co., 3209 Humboldt St., Los Angeles 31, Calif.



CANNON TERMINAL BLOCK

Open Blade 2-Pole Switch

A compact snap-action open blade switch is available for 2 pole applications. Both single and double throw contacts can be specified in the unit constructed with a patented beryllium rolling spring. Terminals may be ordered for front or rear connections. Operating pressures are between 3 and 5 ounces. Overall dimensions are 2½ by 3½ by ¾ inch. The switch is rated at 15 amps., 125 volts a-c. Acro Electric Co., 1338 Superior Ave., Cleveland 14, Ohio.



ACRO SWITCH

Multi-Breaker

A new multi-breaker, the MO 4, has been designed for homes and housing projects as a service entrance breaker and a distribution load center. Thermal and high-speed magnetic tripping action are combined in the unit measuring approximately 5 by 3 by 7¼ inches. It is available in single pole branch circuit capacities of 15, 20 and 30 amperes. The coilless magnetic trip clears the circuit instantly under short circuiting conditions. The MO 4 can be converted to a device with one or two double pole 3 wire circuits by means of a furnished handle tie. Federal Electric Products Co., 50 Paris St., Newark 5, N. J.



FEDERAL BREAKER



TODAY... *the Lamp of Learning*
is FIREFLY EQUIPPED!



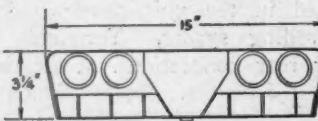
University of Wisconsin Drafting Rooms Get Added Seeability with Firefly Fixtures

Soothingly soft light, without glare or shadow... in the proper amount... and from the correct angle... is delivered exactly where it's needed on these students' drawing boards. This is but one of several University of Wisconsin mechanical drafting rooms at its Milwaukee Extension Division—all equipped with Firefly Super Hi-Lite fixtures.

The Super Hi-Lite is a horizontal type 4-light unit. Its bottom louvers, scientifically spaced, give the 45° angle cut-off from the line of vision, recommended by lighting authorities. Note that these Firefly Fixtures are installed singly, and in continuous rows. This feature not only permits installing the proper number of fixtures but allows *diagonal* installation.

An outstanding feature of the Super Hi-Lite is its remarkable flexibility. Louvers may be added later to a bare-tube installation, should

the lighting needs of a room change. The shallow, graceful twin-section metal louvers slide easily into the fixture, and the flat wafer-like side panels of Alba-Lite, a new Corning diffusing glass, are practically integral with the louvers. These quick-removable louvers insure easy maintenance.



Super Hi-Lite is an Underwriters' Approved Fixture... union made, of double-baked heat-resisting, white enamel... mountable from pendants or to ceiling. Like all Firefly Fixtures, it is distributed exclusively through leading electrical wholesalers. Write for literature.

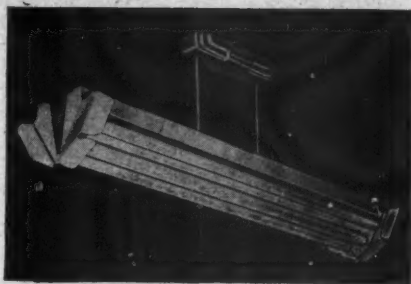
KAHN MANUFACTURING CO., INC.
2051 N. 19th St. • Milwaukee 5, Wis.



THE *Firefly Line* OF FINER FLUORESCENT FIXTURES

Fluorescent Fixture

A new No. 140 series of fluorescent lighting fixtures has been announced. They are for surface or suspension mounting, individually or in continuous runs. Units are available for two, three or four 40 watt lamps.

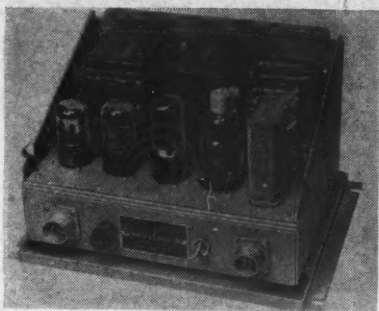


LIGHTING PRODUCTS UNIT

Reflector is removable for simplified hanging and servicing. The chassis is provided with knockouts and screw holes for any type of mounting. Starters are accessible without necessity of removing lamps. Fixtures are wired with 110-125 volts, 60 cycle a-c, high power factor ballast. Lighting Products, Inc., Highland Park, Ill.

Voltage Regulators

An addition to the line of a-c voltage regulators is model D-500, designed for general industrial application and airplane use. Lightweight fostered transformers are employed in the hermetically sealed assembly. The input voltage range is 95-125 with an output

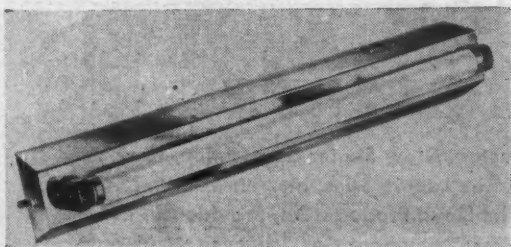


SORENSEN REGULATOR

range of 110-120 volts. The load range is 50-500 va. and the frequency range is 360-500 cycles. Harmonic distortion may run as high as 15 percent although distortion less than 5 percent may be obtained on special request. Transient recovery time is given as approximately 0.1 sec. The D-500, weighing 12.5 lbs., was designed to withstand ambient temperature ranges of minus 55 to plus 70 degrees. C. Sorensen and Co., Inc., Stamford, Conn.

Fluorescent Wall Bracket

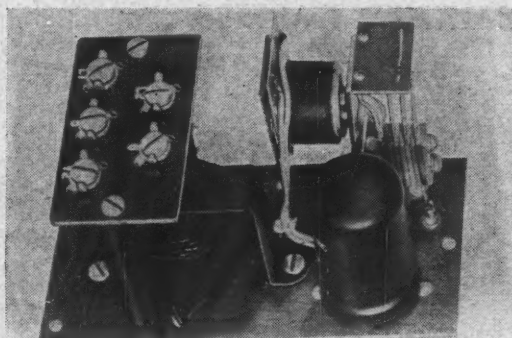
A modern decorative wall bracket for baths, kitchens, recreation rooms and incidental lighting in the home as well as in commercial locations has been designed for fluorescent lamps of 14 and 15 watts. The socket has a positive contact that locks the lamp in place and the lamp is connected with the starter internally. The bracket is chrome plated steel. Convenience outlet, incorporated in the bracket, is optional. Mastercraft Electric Co., 181 Bruce St., Newark 3, N. J.



MASTERCRAFT FLUORESCENT WALL BRACKET

Electronic Relay

This electronic relay uses the hot cathode thyatron principle and may be used in electrical control circuits. Characteristics are snap acting; high load contact capacity; trips by either an external contact carrying only three microamperes or any external circuit whose value drops to one megohm pure resistance. Applications for the device are in photocell circuits for direct controlling actuation of motors, valves, alarms; motion and limit control within micro inches; converting delicate contact making instruments; and liquid level control. Operation is from 110 volt, 60 cycle a-c lines. Switching action is SPDT, or up to 4 PDT for loads to 12 amps., 110 volt, a-c non-inductive. Mercury contacts are supplied for contacting loads to 30 amps. Automatic Temperature Control Co., 34 E. Logan St., Philadelphia 44, Pa.



AUTOMATIC ELECTRONIC RELAY

Wire Stripper

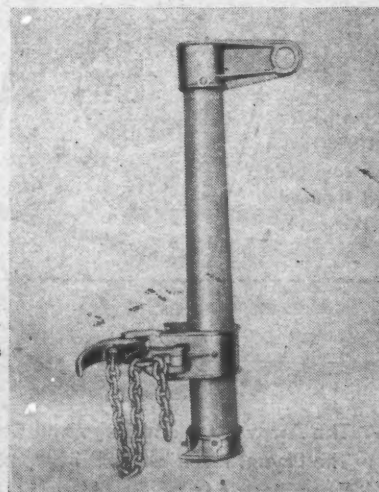
The insulation of wire from size 8 to 30 can be stripped with Speedex 733-K Stripper Kit. Seven interchangeable blades are contained in steel case. Recommended for use by electricians, service men, mechanics and factory production men. General Cement Mfg. Co., 919 Taylor Ave., Rockford, Ill.



GENERAL WIRE STRIPPER

Transformer Gin

This new transformer gin is for hoisting small distribution and rural line transformers, circuit breakers and reclosers. It may be mounted on wood or steel poles and is held securely by a specially designed chain tightener which is locked in place with a safety latch. The hard wood mast is laminated. The gin is rated to lift 1500 pounds maximum load. A. B. Chance Company, Centralia, Missouri.



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The Manufacturers of

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The Bryant Electric Co., Bridgeport, Connecticut
Dura Electric Lamp Co., Newark, N. J.
General Electric Co., Bridgeport, Connecticut
Harvey Hubbell, Inc., Bridgeport, Connecticut

Instant Glow Starter Corporation, New York, N. Y.
Kuthe Laboratories, Inc., Newark 4, N. J.
The Lloyd Products Co., Providence, R. I.
Pass & Seymour Co., Syracuse, N. Y.
Sheldon Electric Co., Irvington, N. J.

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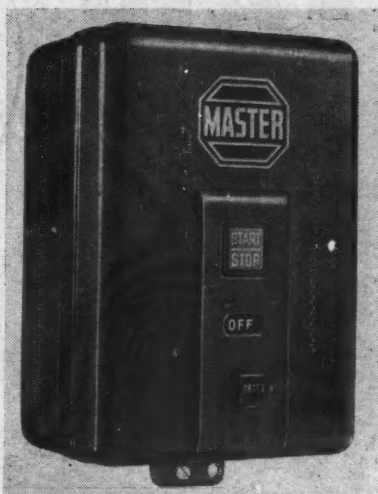
A-C

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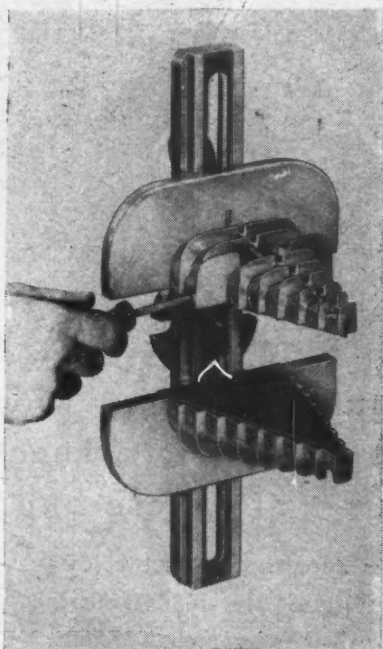
A-c across-the-line starters feature a single push button for starting and stopping squirrel cage motors. Of solenoid type with vertical straight line motion and using bridge type contacts, the starters have a single button, ON-OFF indicating flag, heavy metal enclosure and double contact moving contacts. One remote control station can be used with a starter of any voltage 110 to 550 or frequency 25 to 60 cycles. Master Electric Co., Dayton, Ohio.



MASTER STARTER

Coil Winder

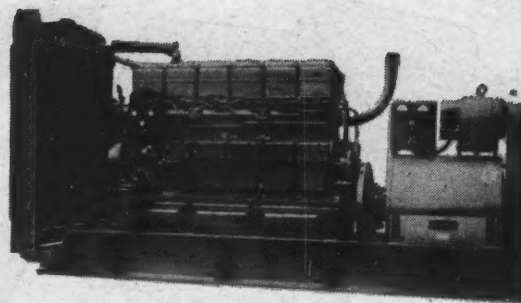
Model U adjustable concentric winding head, comprises nine pair segments, large to small sizes, eight of them adjustable by means of a screw. By referring to a chart which is supplied with each winding head, the operator in a few seconds can set the segments to the proper dimensions for the winding under consideration without removing head from the machine. It is claimed that the electrical motor repair shop, by using the concentric winding head, can save many hours in set-up time. It makes concentric coils for all types and sizes of single phase motors, from a coil for a 1/20th hp., 24 slot 6 pole stator to coils for a 3 hp., 36 slot 2 pole stator. The Continental Electric Co., 650 N. Prairie Avenue, Hawthorne, Calif.



CONTINENTAL COIL WINDER

A-C Generators

New line of a-c generators, made in 8 and 10 poles, is desirable for direct connections to 720 and 900 rpm. engines. Alternator can be furnished with either single or double bearings to permit direct carriage of drive end of alternator on engine drive shaft. Ball bearings are cartridge type. Frame is steel. All exciters are shunt wound and can be furnished at either 125 or 250 volts d-c. High

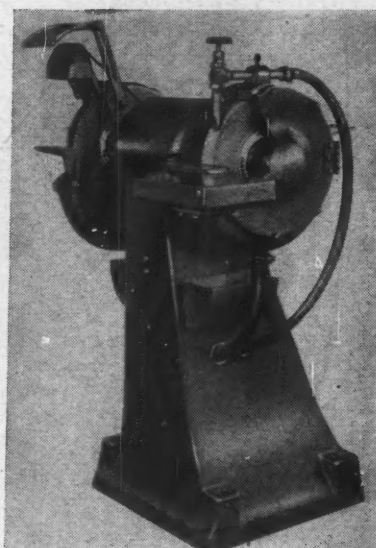


KATO GENERATOR

efficiency stator is heavily insulated. Generators are available in 2 and 3 wires, single phase, and 3 and 4 wire, three phase, for voltage combinations, such as 110-220 volts for single phase and 208-120 volts, 3 phase or 440 volts 3 phase. Kato Engineering Co., Mankato, Minn.

Heavy Duty Grinder

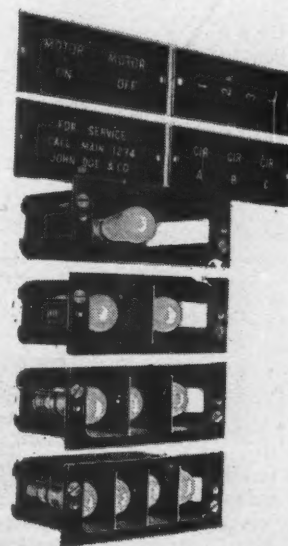
Combination wet and dry grinder, designed for Navy use, has water trap and dust collector built into base for protection. Wet side is enclosed. Dry wheel guard is equipped with removable eye shield and an exhaust outlet. Other features are push button motor starter with low voltage and overload protection, spark shield and wheel light on the dry side and fine grinding wheels. Brown - Brockmeyer Co., Dayton 1, Ohio.



BROWN-BROCKMEYER GRINDER

Indicating Light

A new lighting device, known as the ML unit, has been announced. The basic lampholder housing can be furnished for use with one, two, three or four S6-120 volt bulbs or smaller diameter bulbs. Slots are provided as an integral part of the case to hold light isolation barriers. Cross ventilation is provided to each lamp chamber. When the lamp lights, the message is illuminated either in white or in color. Momentary contact and on-off push switches which light up, can be used with or without markings. The H. R. Kirkland Company, Morristown, N. J.



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Nationally distributed through leading electrical supply houses.
In Canada: address all inquiries to Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.



IT'S EASY TO SEE WHEN IT'S

DAY-BRITE

Modern Lighting

Silent Salesman Sells Shoes

Combining established standards of well planned lighting with attractive modern architectural and decorative features is the achieved objective of the Ansonia Shoe Company's Philadelphia salesroom. Brilliantly illuminated exterior display windows and an attractive cold cathode foyer showcase invites customer inspection of the restful interior sales salon and silently promotes sales.

Three continuous parallel rows of two-lamp 40-watt white fluorescent fixtures are recessed behind sanded glass panels, flush mounted in the exterior ceiling between two display windows which, in turn, are lighted by recessed incandescent downlights and theatrical spots for highlighting featured displays. The main sales room is walled by rippled bleached-oak panels, cove lighted along the top by 40-watt daylight fluorescent lamps installed end-to-end with sockets overlapping to prevent dark spots. Along the center line of the salon ceiling, graceful hanging lighting fixtures are suspended beneath circular aluminum air conditioning louvred vents. Each silvered fixture consists of eight luminous indirect frosted globes containing 60-watt incandescent lamps surrounding a central direct-indirect venturi-shaped cone holding a 150-watt lamp. Molded glass rosettes below these cones emit diffused downlight, prevent glare from direct source brightness and add a decorative touch to the fixture.

Wall cases are recessed behind two zebra-wood veneered counters which flank the main entrance. These cases are illuminated from above by recessed and louvred 40-watt white fluorescent lamps that adequately light displayed accessories presented in the mirror-backed, glass-shelved cases. Ceiling recessed 150-watt spotlights behind lensed plates furnish high intensity local illumination for counter display and wrapping.

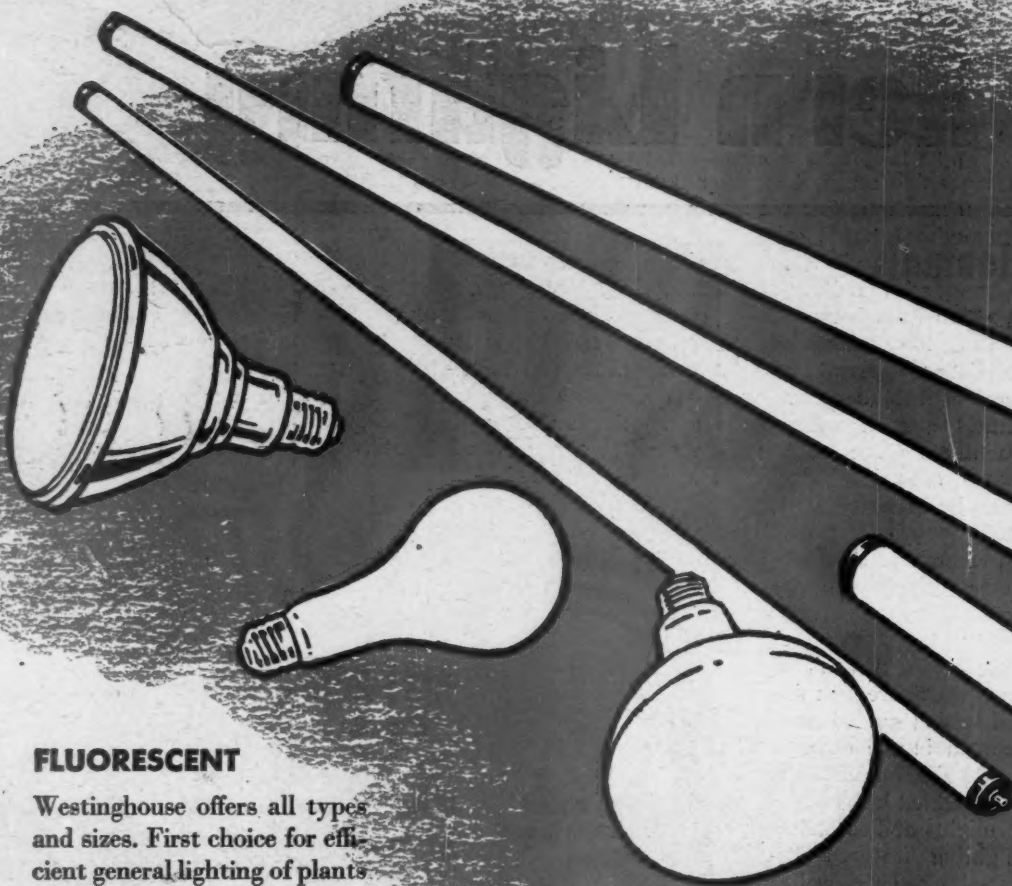
A small salon, located at the rear of the main salesroom, is lighted by continuous cove lamps and downlights placed above the large circular panel. The two salesrooms are separated by bleached-oak columns containing vertical recessed fluorescent lamps directing light towards the curved walls.



Fig. 1—Looking towards the rear salon, the specially designed hanging fixtures are noted below the louvred air conditioning ducts. The rear salon is lighted by a dropped center ceiling containing edge cove and recessed downlights. Columns on either side of the wide arch contain vertical fluorescent strips that augment wall lights in providing general illumination.



Fig. 2—Rippled side walls contain overlapping fluorescent lamps behind the top edge, directing light towards the ceiling. Recessed wall cases behind the front counters are top lighted by louvred, recessed white fluorescent lamps. Additional local light is provided by ceiling recessed spots. Liberal use of mirrored walls increases illusion of spaciousness.



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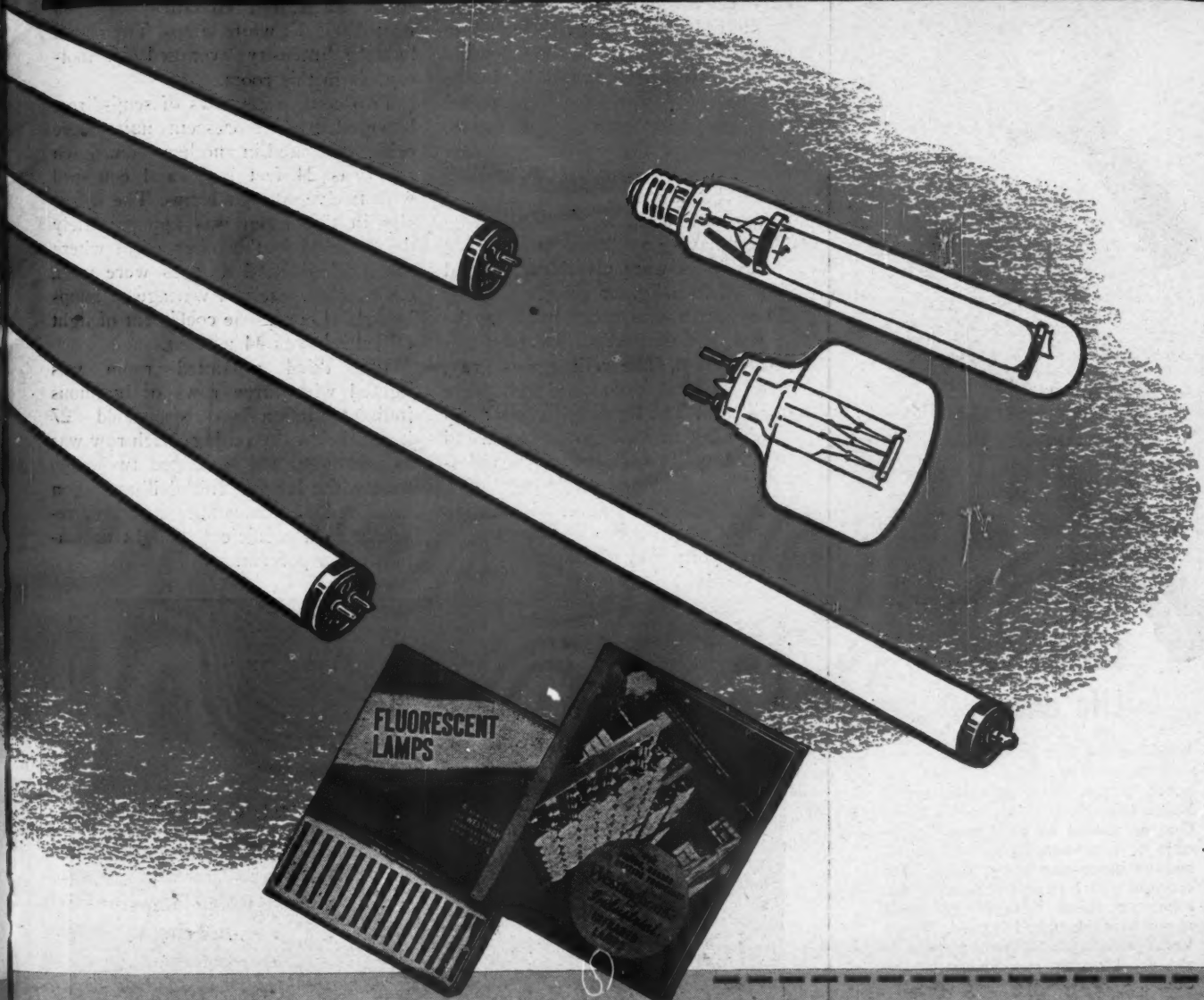
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—MCGILL—

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These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded — an additional safety feature.

—MCGILL—

MANUFACTURING CO., INC.

Electrical Division
VALPARAISO, INDIANA

Better School Lighting Shown

A full scale demonstration and test of better lighting for schools was made recently in Prince Georges County, Md. School officials, in cooperation with the Potomac Electric Power Company, Washington, D. C., used four classrooms of the same size for the test. This made it easy to evaluate the lighting equipment, paint, and other factors used to improve seeing.

Each room was 21 feet by 30 feet in size, with a 12-foot ceiling height. Three of these rooms were completely repainted and properly conditioned for better brightness contrast ratios. Ceilings were finished flat white with 85 percent reflection value. The white finish was extended down the sidewalls 18 inches. Upper sidewalls of inside partitions were painted a light pastel green with 65 percent reflection factor, and interior of the outside wall was painted a sun yellow. Dado and all trim on blackboards, doors and windows were finished in a darker shade of green, having a 40 percent reflection factor. Floors were also bleached and refinished in a lighter color.

The fourth classroom used in the test was left untouched, for purposes of comparison. The ceiling was gray, walls buff, and dado and trim were dark brown. The lighting in this room was also left in its original form, and consisted of two 300 watt incandescent lamps in semi-direct enclosing glass globes. The resultant illumination averages about three footcandles, is uneven, spotty and glaring.

Each of the three paint conditioned rooms were relighted. Three different types of fluorescent luminaires were used, a separate type being selected for each room. This permitted comparable technical data to be made for each type fixture, including resulting foot-candle and brightness results. Visual inspection of the rooms was relied upon for appearance, finish of fixtures, seeing comfort and similar factors which are difficult to appraise by other means.

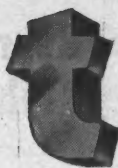
Six individual type semi-direct louvered units, suspended 30 inches from the ceiling, were used to light one room. Each unit contained four 40 watt/3500° K. white lamps. The initial lighting intensity averaged 35 footcandles in this room.

Two continuous rows of semi-direct louvered type fluorescent units were ceiling mounted in another room. Each row was 24 feet long, and equipped with twelve 40 watt lamps. The intensity in this room was approximately the same as in the other room where the six individual fixtures were used, the number, size and wattage of lamps being the same. The coefficient of light utilization was 44 percent.

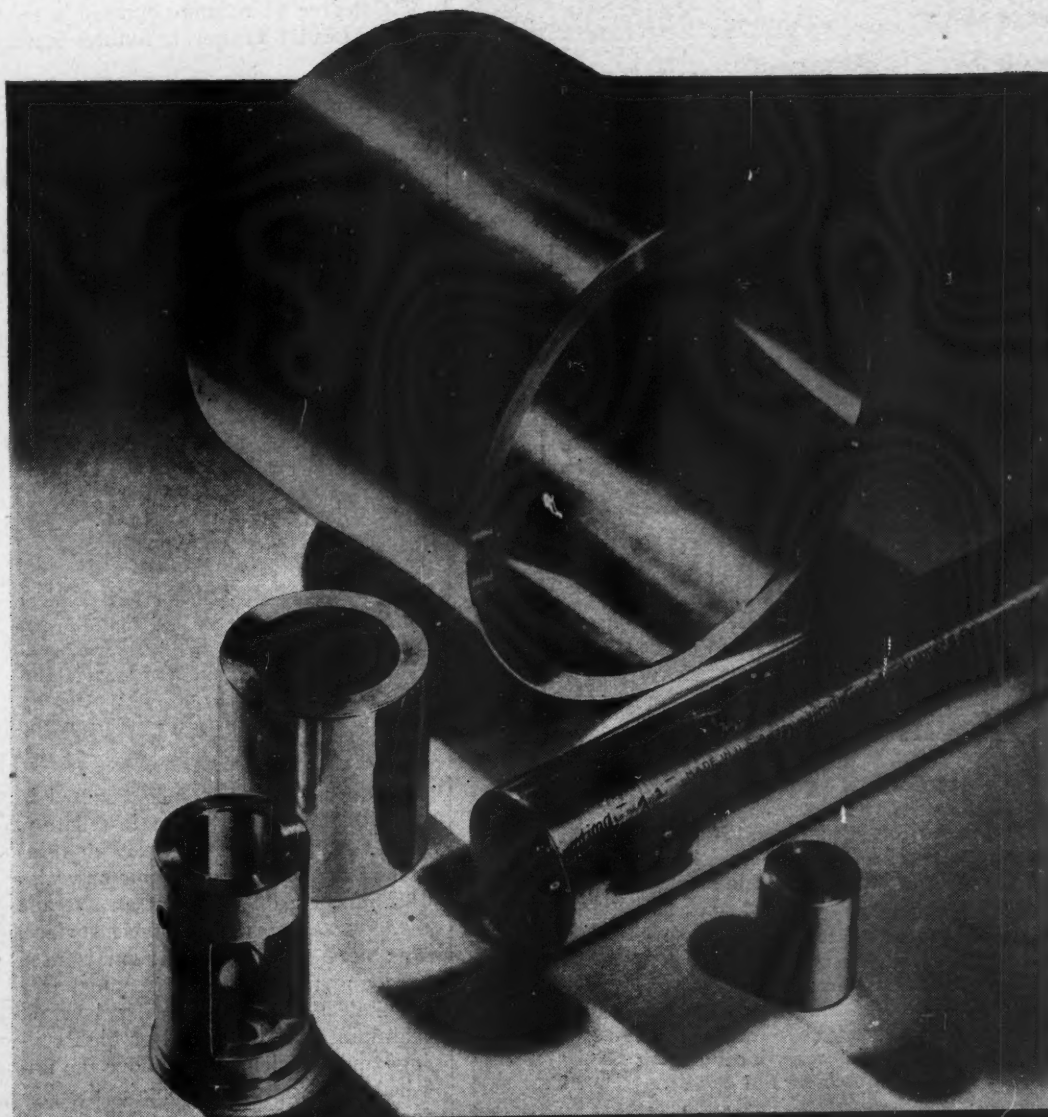
The third repainted room was lighted with three rows of luminous indirect luminaires suspended 27 inches below the ceiling. Each row was 24 feet long, and contained twelve 40 watt white lamps. Initial illumination measured 55 footcandles average, resulting in a coefficient of light utilization of 46 percent.



This is one of three classrooms in a Prince Georges County school at College Park, Md., used to demonstrate and test better school lighting. The rooms, identical in size, were repainted in lighter colors and re-lighted with fluorescent lighting fixtures of different types. The intensity in this classroom averaged 55 footcandles.



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Recreational Lighting

Recreation and rumpus rooms in residences, clubs and community houses require several different types of lighting to properly illuminate the various activities planned for these locations. One of many activities so scheduled is table tennis or ping pong. Two of several methods for lighting a ping pong table are shown in the accompanying photographs.

In Fig. 1 the recreation room is lighted by single 40 watt 48 inch T-12 3500 degree white lamps encased in recessed Leader Trofferlite fixtures faced

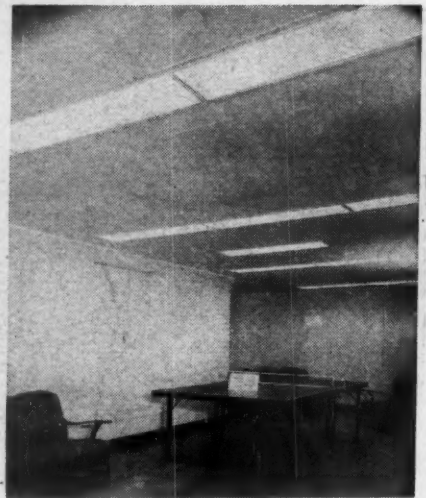


FIG. 1—*Recessed fluorescent fixtures with single lamps placed behind diffusing glass panels give pleasing, general illumination. Higher local lighting may be secured by utilizing multiple lamps in fixtures over the areas in question.*

with diffusing glass panels mounted in piano-hinge frames. The installation, part of an exhibit designed and installed by Chicago's Commonwealth Edison Company, delivers an average of 30 footcandles to the table surface. The same lighting treatment is used throughout the entire recreational area so that a uniform lighting level is maintained. With normal or high ceilings and sufficient space above the finished ceiling line to contain the 8½ inch deep troffers, the combination of single lamps and diffused glass panels gives ample illumination without introducing reflected glare or source brightness to distract the players at the table or the other occupants in the room.

In Fig. 2, a treatment is illustrated which is recommended by the Sylvania Electric Products, Inc., for basement rumpus rooms where ceiling heights are limited and the recessing of fixtures is hampered by beams and covered piping. Long slim fluorescent

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FIG. 2—Low brightness, slimline fluorescent lamps can be advantageously used in rumpus room where lower ceilings and buried beams prevent recessed or large suspended fixtures. Mounting lamps parallel to edges of table prevents glare from table surface distracting players.

lamps are mounted over the edges of the ping pong table at right angles to the net. Since many players stand at a considerable distance behind the serving line, the lamps are carried beyond the ends of the table to properly illuminate the ball in flight during the entire play. Although the lamps are placed closer to the playing surface, their low brightness and their mounting position parallel to the area of action does not create direct glare from the table surface. Where room decorations call for a more ornamental type of lighting fixture, the lamps can be shielded.

Since few recreation rooms are devoted to a single activity, thought should be given to versatility of lighting. In addition to lighting for table games, general illumination, spotlighting for local areas and atmospheric lighting should be considered.

Slim Fluorescents Light Showcases

Showcase tops remain cool to the touch, merchandise is illuminated by an even spread of high-level light, and reflector widths are streamlined to a minimum through the utilization of long, small-diameter fluorescent lamps. Brooks Brothers' New York City tobacco shop reports that such an installation, planned by Sylvania Electric Products, Inc., presents the true quality and color of displayed merchandise. The fine



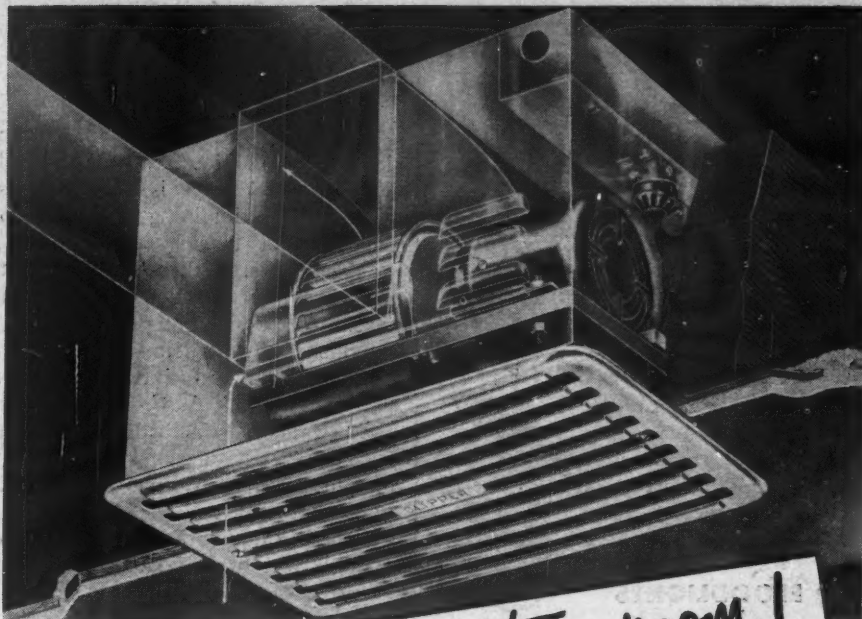
Slender $\frac{3}{4}$ -inch fluorescent lamps, in lengths of 42 and 64 inches, furnish 50 footcandles of illumination to the shelves of showcases in new tobacco shop. An even spread of high-level lighting, a narrow reflector mounted unobtrusively in the forward edge of the case, cool glass showcase tops and higher color fidelity of displayed merchandise are resultants of the installation. General illumination is from recessed ceiling fixtures housing standard fluorescent lamps and wall case top-lighting utilizes 3500 degree white T-12 units.

grains and soft lusters of pipes, humidors, leather pouches and silver lighters are now emphasized to new levels of sales appeal.

Each showcase contains a single $\frac{3}{4}$ inch diameter lamp behind a slender metal reflector installed in the front upper corner of the case. Cases were constructed so that combinations of 42 inch and 64 inch lamps could be used. The installed lamps deliver an intensity of 50 footcandles to the case shelves. In comparison with incandescent lighting employing standard 25 watt tubular showcase lamps spaced on one foot intervals, the illumination from the slim fluorescent is estimated to be doubled while the current consumption is halved. Since the light source is continuous, hot spots are absent and equal emphasis is placed on all products in the case.

Standard fluorescent lamps are used behind the recessed ceiling fixtures to furnish general illumination and above all wall cases to highlight the larger displays presented on the plate glass shelves.

In designing showcases, it should be borne in mind that slimline lamps can also be specified in the 72 and 96 inch lengths. The diameter of 1 inch is in proportion to the length.



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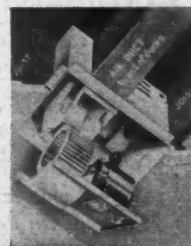
KITCHENS, bathrooms, ticket booths, X-ray rooms, toilets, clinics and numerous others are the forgotten rooms of every building. They badly need ventilation and Clipper Ceiling Blowers are specifically designed to do the job better—at a good profit to you.

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Hosiery Shop Sells With Light

Combining fluorescent and incandescent illumination in a wall and ceiling planned design is pleasing customers and maintaining peak sales for the Constant Hosiery Store in Milwaukee, Wis. General illumination, sales area lighting, stock shelves and special display highlighting are accomplished by judicious selection of available, standard fixtures. The installation was by A. C. Electric, Inc., of Milwaukee, in accordance with the lighting layout developed by Charles Laupp of the Wisconsin Electric Power Company.

General illumination is furnished by a single line of Day-Brite fluorescent fixtures, each unit housing four 40-watt lamps, flush mounted on the store ceiling directly over the center line of the aisle. Mounted end to end, the side panels of ribbed diffusing glass transmit 3500-degree white light with a counter level intensity of 40 footcandles. Pittsburgh Permaflexor C-101-5 reflectors were selected to furnish down lighting over merchandising counters and window display cases. Containing 150-watt incandescent lamps, the recessed units are installed on 30-inch centers over the outer edges of the counters and tipped slightly towards the wall to eliminate the possibility of reflected glare reaching the eyes of customers. With down lights augmenting the general illumination, a light intensity of 150 footcandles is delivered to the counter tops. To light

the merchandise shelves occupying the wall behind the sales counters, continuous cold cathode tubing has been installed behind the shielding overhead cove. The wall space above the merchandise shelves is broken by shallow shadow boxes displaying hosiery on molded plastic forms. A 20-watt 3500 degree white fluorescent lamp, mounted above each case, back-lights these displays and emphasizes the quality of the merchandise.

The store windows, behind the counters on the left, extend to the ceiling line and create the effect of an open side. The attractive interior, visible from the sidewalk, is a constant advertisement. The combination of fluorescent and incandescent lighting follows the trend of utilizing more than a single type, color and mode of illumination. A cross-store light-peak curve places the highest intensity over the forward edge of the sales counter where merchandise is under closest scrutiny. Consumption is approximately 9 watts per square foot.

The general decorative treatment of the store is functionally planned and executed in unobtrusive harmony. Inclined mirrors beneath the sales counter permit clerks to glance downwards through the counter tops to note the reflected color and grade of a customer's hosiery. Wall treatments of veneer paneling and simple painted motifs complete the restful background of the salesroom.



Store devoted to sale of hosiery has installed combination of light sources designed to tastefully emphasize displays, indicate completeness of stock, highlight merchandising counters and furnish general diffused illumination to aisle area. Incandescent down lighting augments standard fluorescent fixtures and concealed cold cathode strip.



Industrial Electrification

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Overload Protective Devices—Part III

The third of a series of articles reviewing circuit protective methods. This article discusses applications of the types described in preceding articles.

This discussion will be confined to the simpler applications of some of the more common types of electrical protective devices described in preceding articles and as found in industrial plant distribution systems.

Despite the precautions taken to design trouble free and reliable electrical apparatus, to lay out a system that will afford continuous service under all kinds of conditions, as well as to provide proper operation and maintenance of the equipment, interruption to the service and damage to equipment is still possible due to faults resulting from unavoidable defects which may develop, lightning, accidents, failure of the personal element and similar unpredictable causes.

While a protective device will not necessarily prevent faults from occurring it will help to eliminate undesirable interruptions in production, reduce damage to equipment and minimize the overall system disturbance when a fault does occur. The degree of protection afforded will depend upon the extent of the protective equipment provided, the expenditure for which in turn is determined by the probable improvement in service which will result and the amount of damage which will be prevented if trouble occurs. The increased safety to life and reduction of fire hazard are other considerations which should not be ignored when considering the cost of protection.

The most common of all protective devices is the overcurrent device and its use and importance merits a brief explanation. Overcurrent and overload in electrical terminology are essentially synonymous; they both apply to a condition where the cur-

By C. F. Hedlund
Electrical Engineer
Associated Factory Mutual Fire Insurance Companies, Boston, Mass.

rent in a circuit or machine is more than normal due to an excessive number of current consuming devices on a circuit, or a machine or motor being

loaded in excess of its rating, or short circuits on the supply conductors or in the equipment itself. Hence an overcurrent (or an overload) device, as it is sometimes called, is for the purpose of protecting the circuits or machine against damage due to excessive temperatures resulting from abnormally high current.

Protection of Power Transformers by Means of Differential Relays

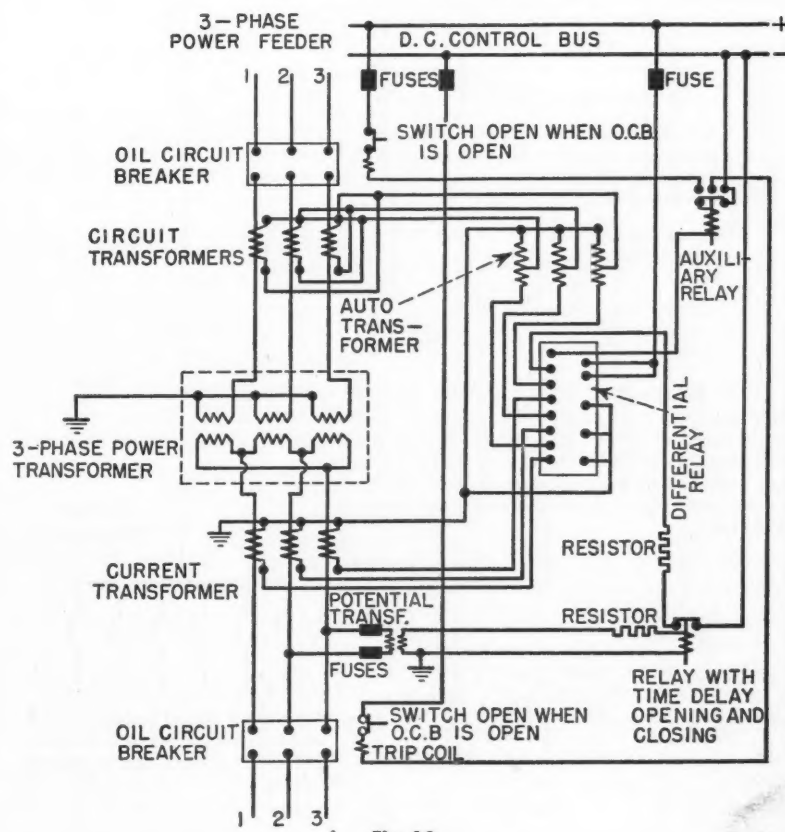


Fig. 13

Protection of Transformers

The extent of protection provided for a transformer bank varies with its size, voltage, importance, and its arrangement in the system. Large power transformers are in most cases protected with overcurrent, differential and sometimes gas pressure relays. Distribution transformers are often protected only by fuses in the primary circuit.

In general, differential protection is not provided for transformer banks smaller than 1000-kva., as it is necessary that there be a circuit breaker on each side of the transformer into which power can flow in order to disconnect it completely in time of trouble. If the transformer is not already provided with both primary and secondary breakers the conditions may not justify the expense of providing the necessary additional circuit breakers.

Fig. No. 13 shows the typical method of connecting a percentage dif-

ferential relay for protecting a three-phase two-winding power transformer. The arrangement shown will provide protection for faults between phases or windings, faults to ground and turn to turn faults which may occur within the "zone of protection". The latter includes all equipment located between the two sets of current transformers on the primary and secondary leads of the main transformer. The differential relay will not protect against external short circuits or overloads. By shifting the current transformers to the opposite side of each of the circuit breakers shown in the sketch the zone of protection can be extended to include faults in the circuit breakers and their leads in addition to the power transformer leads.

Differentially protected transformers are often provided with overcurrent protection as well, in order to have "back-up" protection for isolating the part of the system at fault should the

principal protection fail to operate as planned. The "back-up" protection is another line of defense and is best arranged by causing different circuit breakers further back toward the source of supply to trip rather than those close to the fault which would ordinarily trip upon operation of the principal protection; although the "back-up" protection may be arranged to trip the same circuit breakers if desired.

Figures 5 and 6 of the previous articles show typical arrangements of the overcurrent relays, but for the protection of three-phase transformer banks, the National Electrical Code requires an overcurrent relay for each ungrounded conductor, rather than only two as shown in the sketches.

When it is not practical to provide differential protection for large transformers, overcurrent protection should be applied and should be coordinated with other protective devices so that only the part of the system at fault is isolated. The overcurrent protection may consist of primary fuses or overcurrent relays with a circuit breaker. If fuses are provided on the primary side of a transformer it is usually desirable to install a circuit breaker on the secondary side so that the consumer may have some easy and safe means of controlling the current into his plant in emergencies, as well as providing necessary protection for secondary conductors.

For small or medium sized transformers primary fuses will furnish satisfactory protection and are used extensively. In their application the following factors must be given consideration, the full load current rating of the transformer, the maximum short circuit current available from the supply system, the circuit voltage, the magnetizing current of the transformer, coordination with other fault current protective devices, and the characteristics of the load.

When circuit breakers are available, protective relays of the type mentioned are preferable. Better protection and coordination with other protective devices will be afforded because the relays are much more consistent and accurate than fuses insofar as tripping time and current is concerned.

Temperature relays are also available to prevent seriously overloading power transformers. One type is provided with temperature detector coils which are controlled by the temperature of the transformer windings. If the transformer is overloaded to a dangerous degree the relay will operate and trip the breaker, or will operate an audible or visible signal to attract

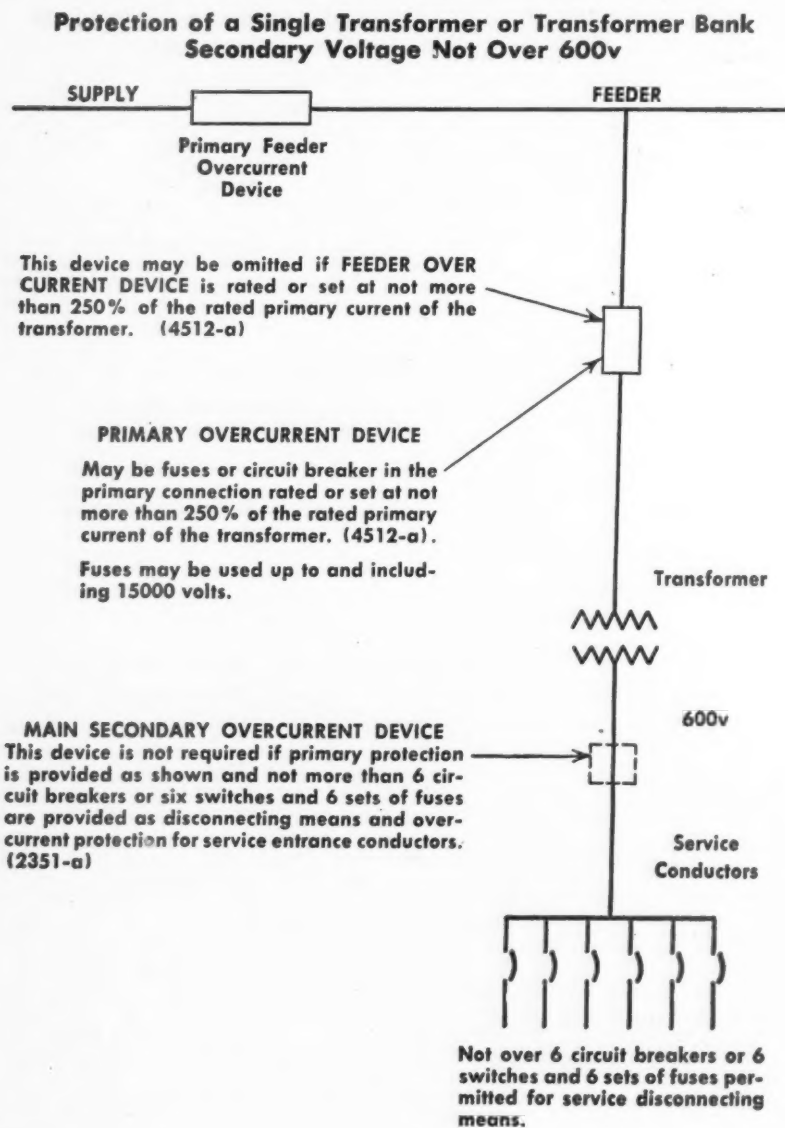


Fig. 14

the attention of those in charge. Since the temperature relays are entirely dependent upon the temperature of the transformer windings they have the desirable feature that they will not trip the transformer from the system needlessly as in the case of some external faults. Where only overcurrent relays are depended upon to prevent overloading they are ordinarily arranged with a long time setting to prevent unnecessary interruptions. In some cases directional relays are used in conjunction with overcurrent relays to provide faster and more selective tripping in the event of a short circuit in the transformer.

Gas pressure relays have not been used to any great extent in this country and their use has usually been confined to the larger oil insulated transformers. They are generally arranged to notify an operator by means of an audible or visible alarm when excessive internal pressures develop within the tank as a result of a slowly developing fault.

Consideration should also be given to the fire hazard of oil insulated transformers. Fortunately a transformer is an exceedingly reliable piece of apparatus and fires do not always accompany the occasional failure. However, serious fires in them do occur and where considerable quantity of oil is involved and valuable property is exposed extensive damage usually is the result. Transformers of 100-kva. or larger should not be located nearer than 25 feet to important buildings or other valuable structures which could be damaged by burning oil from the transformers. Means should be provided for draining away to a safe place any oil that may be expelled or released and if the transformer cannot be safely isolated or installed in a masonry vault the hazard can be safeguarded by protecting it with an automatic water spray or carbon dioxide system. Many large transformer stations, both indoors and outdoors, are so protected today and increasing recognition is being given of the need for such protection.

The requirements for overcurrent protection of transformers as outlined in the 1947 Edition of the National Electrical Code which will very soon be available for general distribution, are shown graphically in the accompanying illustrations. The new 1947 Code rules which will apply are indicated by the figures enclosed in parentheses. These illustrations apply to power and distribution transformers and do not include current transformers, transformers for low energy and signal circuits, transformers for

sign and outline lighting, transformers for electric discharge lighting, or transformers for X-ray and high frequency.

Protection Of Generators

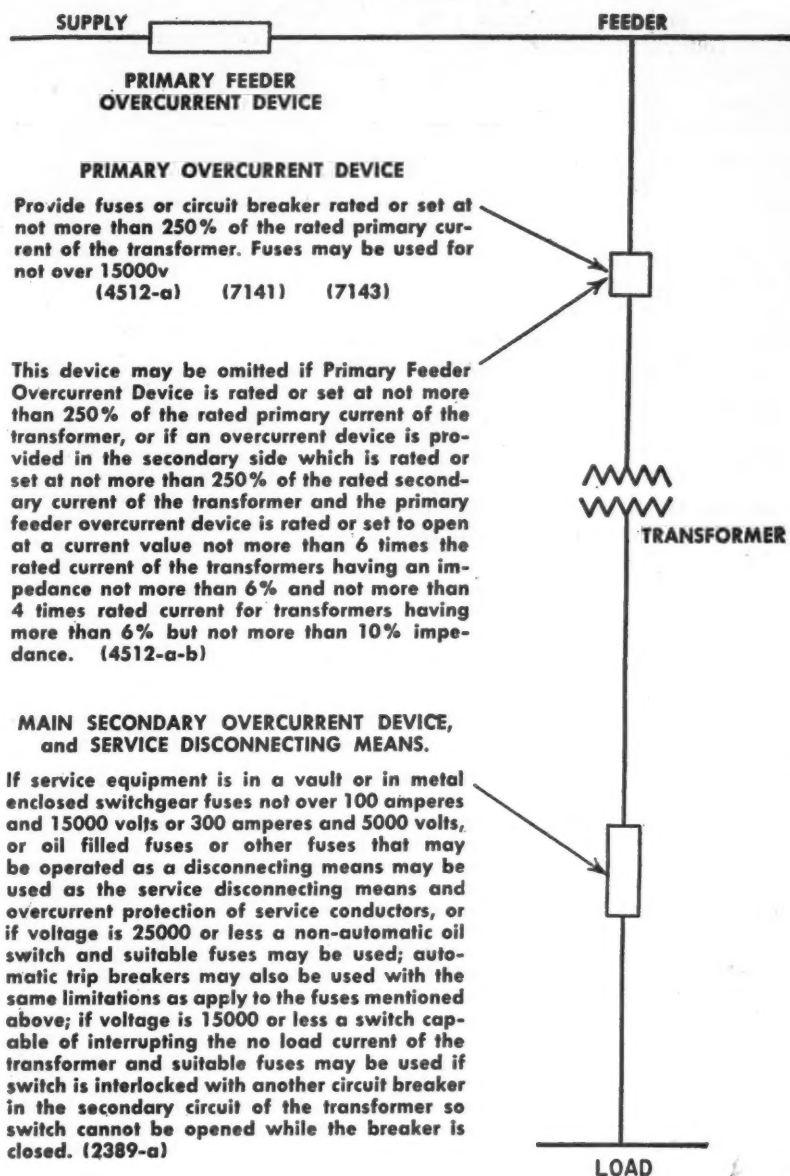
D-C GENERATORS

This type of machine must be protected from excessive currents with either fuses or circuit breakers de-

pending upon the size, as required by the National Electrical Code (see Section 4454). Circuit breakers are preferable for the more important installations because they can be reset with little loss of time, such as might occur if a fuse blew and another one was not quickly available.

Two-wire generators as permitted by the Code "may have overcurrent protection in one conductor only if the

Protection of A Single Transformer or Transformer Bank Primary and Secondary Voltages over 600v



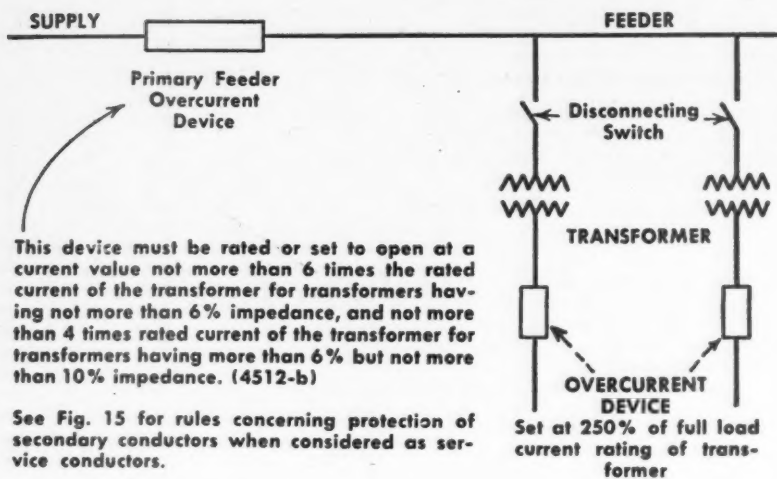
If service equipment is not in a vault or metal enclosure the service disconnecting means and overcurrent protection of service conductors shall consist of an automatic trip circuit breaker of suitable carrying capacity and interrupting capacity. (2389-b)

If the voltage of the circuit exceeds 5000 the circuit breaker must be in a metal enclosure such as metal-clad switchgear or be in a fire resistant switch room or vault and if the circuit voltage exceeds 15000 volts such apparatus must be in a vault in any case. (7135)

Fig. 15

PROTECTION OF TWO OR MORE TRANSFORMER BANKS ON SAME FEEDER

Individual Primary Protection Not Needed with Arrangement
Shown Below (4512-b)



NOTE: — If the transformers shown above are equipped with coordinated thermal overload protection by the manufacturer, individual primary protection is also not required if the primary feeder overcurrent device is rated or set as specified, also the overcurrent devices in the secondary circuit may be omitted unless secondary conductors are considered as service conductors and the overcurrent devices otherwise needed for their protection and as a disconnecting means.

Fig. 16

TRANSFORMERS IN PARALLEL

"If transformers have electrical characteristics such that they will divide the load in proportion to their rating they may be protected as a unit" — (4514). This rule is illustrated in the diagram shown below.

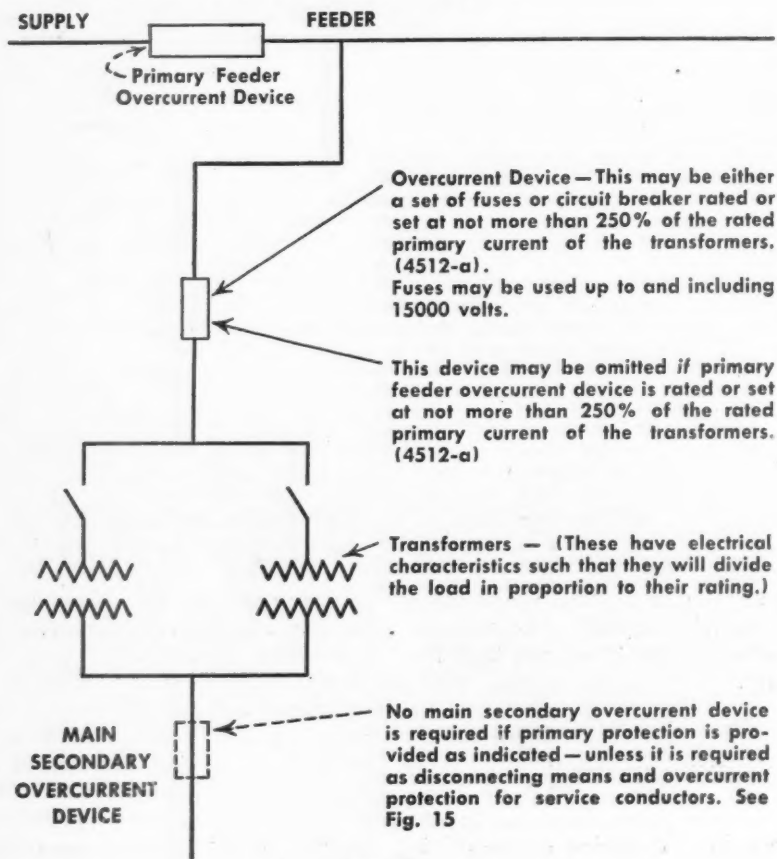


Fig. 17

overcurrent device is actuated by the entire current generated, except that in the shunt field. The overcurrent device shall not open the shunt field". On ungrounded systems however, the generator is commonly protected with double-pole circuit breakers with two overcurrent trip coils. On grounded 2-wire systems if only one circuit breaker is provided it should be placed in the ungrounded lead but the best protection will be afforded with a breaker in each lead. In the event of a fault within the generator the breaker in the grounded lead will prevent current from being fed back into the fault after the breaker in the ungrounded lead has opened.

In the case of 3-wire generators an overcurrent device should be installed in each armature lead and may be either a double-pole, double-coil circuit breaker or a 4-pole circuit breaker connected in the main and equalizer leads and tripped by two overcurrent devices, one on each armature lead.

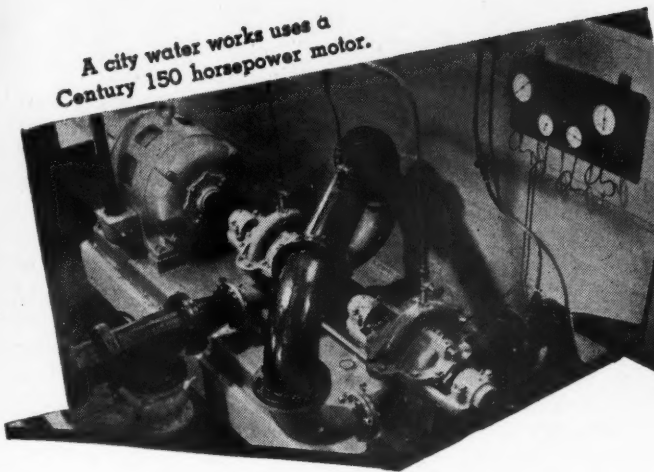
Alternating Current Generators

Where there is only one generator which operates independently of all other sources of electrical energy it is customary and permitted by the National Electrical Code to omit ordinary overload protection for the machine itself although differential relays may be provided to protect it against internal faults. With a single source of power it is usually desirable that the power supply continue without interruption regardless of the troubles that may occur on the external circuits, in such cases a manually operated switch is generally provided for disconnecting the generator from the system. In the event of a sustained system disturbance, the opening of the switch is left to the judgment of the operator. When the generator is normally unattended, overcurrent protection is sometimes provided.

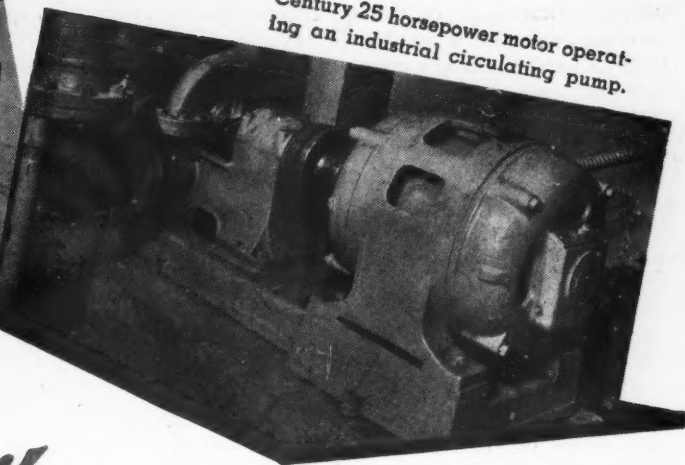
A-c generators are best protected against internal faults by the use of differential relays as shown in Figure 10 accompanying the previous article. These are arranged to trip the main circuit breaker and the field switch together. The field circuit must be opened at the same time because as long as the machine continues to rotate with the field energized it will be generating current which will feed into the fault and may increase the extent of damage even though the main breaker is open. Some turbo-generators will coast 15 or 20 minutes or more after they are disconnected from the line.

To provide differential relays the

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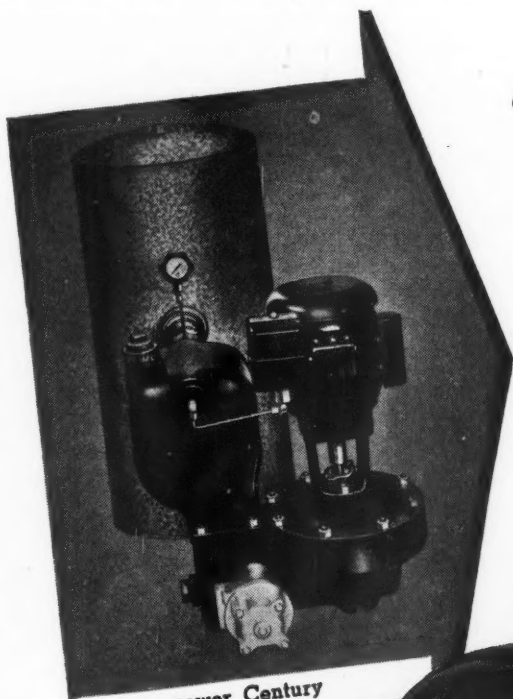


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neutral connections of the generator windings must be accessible in order to install the necessary current transformers. In some machines the neutral connections can be brought out at a reasonable cost but in others it is impractical. On many "Y" connected generators the ends of each phase winding are brought outside the machine so that they are readily available for the installation of the necessary current transformers, but in "delta" connected machines this is not generally the case unless it was specifically ordered by the customer when the generator was purchased. It is not considered economical practice to provide differential protection for generators under 1000 kva.

Valuable generators in unattended stations are usually protected against underspeed, overspeed, overvoltage, loss of oil pressure for governors and bearing lubrication, excessive temperature on windings and bearings, loss of field excitation, and loss of synchronism if operated in parallel with other generators or system.

When a large generator and transformer are operated as a unit, they are sometimes protected by means of a single set of differential relays. However, more sensitive protection will be afforded the generator if sep-

arate differential protection is provided for each unit.

When an important or valuable generator is operating in parallel with another generator, or another source of power, reverse current relays should be installed. A relay with a time lag feature is usually provided in this connection to prevent operation of the generator breaker in case of momentary reversals due to synchronizing or surges. In such cases more sensitive protection against internal troubles will be provided for each generator if differential relays are installed, but in the event that the neutral connection of a "Y" connected machine is inaccessible, or a machine is "delta" connected and it is too expensive to change the connections to accommodate the current transformers needed for the differential relays, the reverse current relays will provide reasonable protection.

Overcurrent relays will afford some measure of protection against an internal fault in a generator operating in parallel with another source of power but they cannot be considered a good substitute for differential relays. They are necessarily not fast in operation in order that they will not operate in the event of external short circuits on the system or momentary overcurrents

and they will not open the field switch when the main breaker opens.

Overcurrent relays are usually considered necessary in unattended stations to protect a generator against external faults or overloading the machine.

Totally enclosed turbo-generators of 3000 kva. and larger, regardless of the voltage classification, should be equipped with some means of fire protection. A fire in such a machine is inaccessible and without some form of built-in fire protective equipment there is no means of applying extinguishing agents until the end bells are removed. This operation may take 30 minutes or more, if all goes well, and by that time extensive damage will have been done. The insulation of the end turns of the stator windings on machines of the size mentioned represents a considerable amount of combustible material. A fire in this material when ignited by an arc from an internal fault, is fanned by the rotor and burns fiercely. If it is not quickly extinguished considerable damage to laminations, frame, shafting and windings will result. In one case, about two years ago in Canada, an unprotected turbo-generator was so severely heated from a fire in the windings that the main frame cracked and had to be entirely replaced.

Two methods of protection are commonly used to safeguard such machines against extensive fire damage. The first and least costly, is the use of rings of perforated brass pipe installed in the end balls of the machine and connected to a reliable clean water supply in such a manner that the end turns will be completely covered with a water spray when the water control valves are opened. Two control valves, normally closed, are arranged in series in a break glass cabinet in a convenient location, with a normally open bleeder valve in between them so that there is no possibility of accidental leakage of water into the spray pipes in the generator or premature operation of the control.

The second method of extinguishing fires in generators is by means of a carbon dioxide system permanently piped into the machine. These systems may be arranged for manual or automatic operation.

Hydrogen cooled generators are usually in the larger sizes, around 25,000 kva. and do not require such fire extinguishing systems as such a high concentration of hydrogen is maintained within the machine when it is operating that the mixture will not support combustion and a fire would normally be impossible.

TRANSFORMERS IN PARALLEL

The electrical characteristics of the transformers shown are such that they will not divide the load in proportion to their ratings.

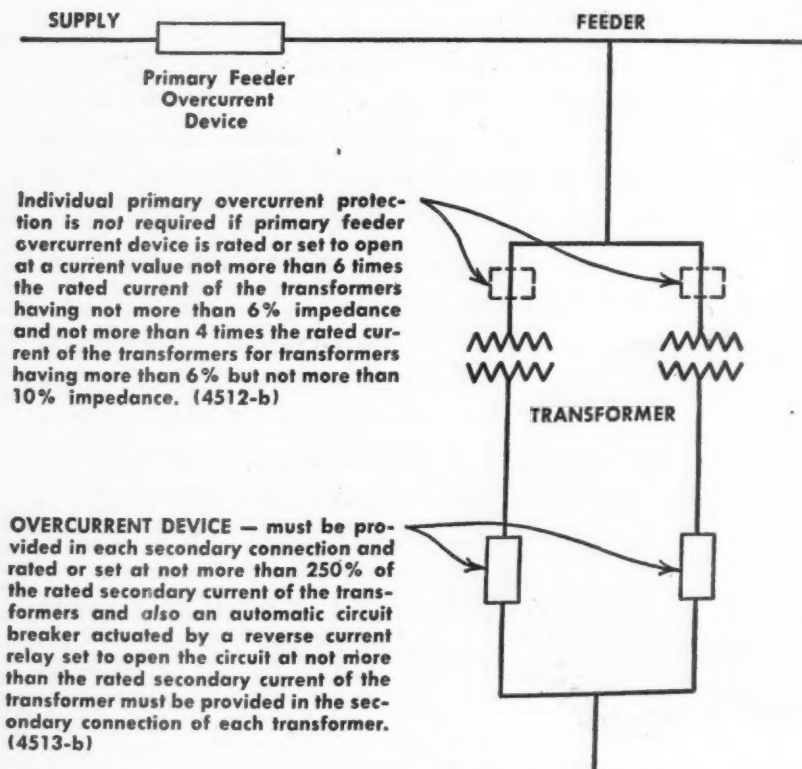
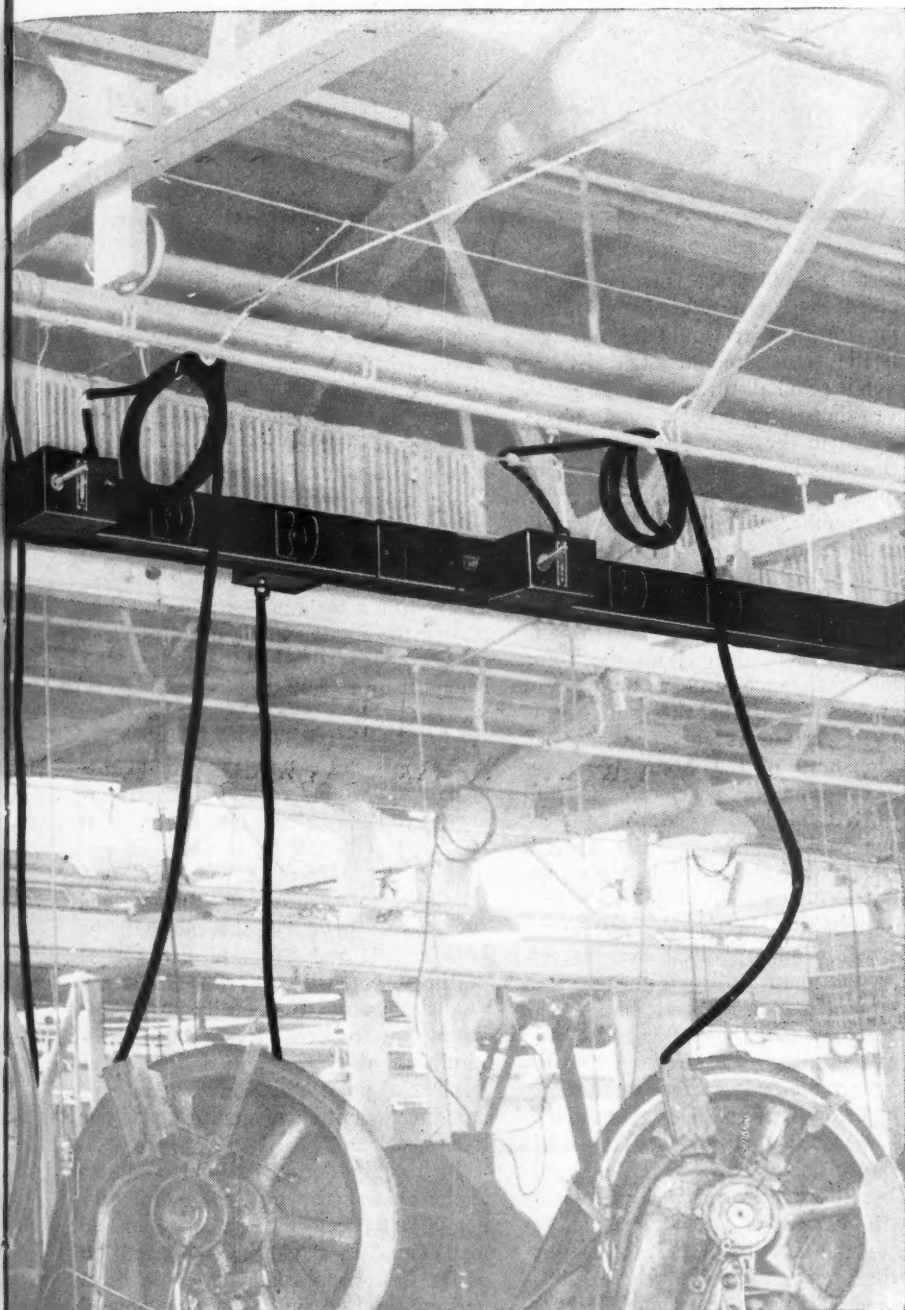


Fig. 18

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Reader's Quiz

Wound Rotor Induction Motor

QUESTION 234—*What would be the effect on a wound rotor induction motor if one of the secondary circuit conductors were opened? (This would also be caused by an open circuit in the secondary controller.) I contend that the motor would operate somewhat as a squirrel cage motor with one phase open, i.e., at reduced speed and torque. Am I correct in assuming this?—W.R.S.*

A. TO QUESTION 234—The effect of opening one circuit of the secondary of a wound rotor induction motor would result in operation similar to a squirrel cage motor. However, such operation would not be desirable except when the motor is operating with a large amount of secondary resistance in the circuit because of the stresses caused by the current unbalance. This so-called single phasing is a feature of many hoist controllers and two-motor industrial drive controllers. The secondary circuit is single phased with all the rotor resistance cut in to give a starting torque as low as 15 percent of the full load torque, which results in extremely smooth control.

Sometimes when accelerating variable loads with wound rotor motors and it is necessary to control acceleration time, a contactor is provided to single phase the rotor circuit at any point of the controller. This contactor is operated by the speed take off device which causes single phase operation with a consequent reduction of torque and conversely a drop in speed in the event that the motor accelerates its load too rapidly.—A.L.P.

A. TO QUESTION 234—If one of the three secondary phase-winding circuits of a wound-rotor three-phase induction motor is open-circuited, the motor will start from

standstill provided the starting torque required does not exceed two-thirds of the torque that would be obtained with the same amount of resistance in each leg and all three legs energized. Due to the setting up of a single-phase condition in the rotor circuit whereby the instantaneous polarities in one of the phase-windings are reversed causing a number of poles twice that in the stator, the rotor will operate at half full load speed over a limited range of load variation.

The pull-out torque at half full load speed will depend on the rotor circuit resistance and a number of other factors. If the external load is below a certain value determined by the constants of the motor, the rotor will continue to accelerate to full speed. At full load speed, the pull-out torque will be higher than at half speed but will always be less than the maximum obtained with the three phase-windings in the circuit. If the external torque required exceeds this value, the motor will pull out and stall without dropping back to half speed. The motor may be returned to half speed operation only after opening the stator circuit and restarting from any point below half speed or from standstill with the load reduced to within the permissible limit.

Due to greatly reduced ventilation which varies as the square of the speed, the maximum permissible operating temperature is reached at a considerably lower loading. The overall heating of the motor is also somewhat aggravated due to the single-phase secondary current component but does not constitute a major factor.

In a case where a 50 hp., two-pole, wound-rotor three-phase induction motor had to be placed in service before the automatic magnetic controller arrived from the factory, two single-pole knife switches, each connected across adjacent slip-rings, were used for starting. The procedure consisted of energizing the stator, then closing one of the switches to accelerate the rotor to about half speed, followed by closing the second switch to bring it up to full speed.

Interconnecting the three slip-rings and attempting to start a wound-rotor induction motor as a squirrel cage motor will show that the rotor locks at certain points. The number of these locking or dead points is equal to the number of phases multiplied by the number of poles. A two-pole, three-phase motor would have six locking points 60 degrees apart. Revolving the rotor by hand or other mechanical means to a position about 30 degrees away from a locking position and then closing the stator switch, usually forces the rotor past the locking points and brings it up to full speed.—R.G.C.

A. TO QUESTION 234—If one of the secondary conductors of a phase wound rotor induction motor is opened then the motor (on starting) will pull in at about 50 per cent of its nameplate rpm. and will continue to operate at this halved rate. The primary current will be unbalanced, and the pull out torque of the motor will be reduced. If the motor happens to be fully loaded, it might fail to start. A trouble of this kind has the effect of doubling the number of poles which gives it its outstanding symptom of operating at one half speed.

In a squirrel cage induction motor, if one phase is opened, the motor will not start (even though there is no load) and if a phase is opened up while it is operating under load, it will continue to operate single phased and it would not be long before the winding would start to overheat and burn up if not stopped.—E.J.K.

A. TO QUESTION 234—A wound rotor motor can be likened to three single phase transformers connected star on delta but the opening of a secondary or rotor winding has the opposite effect.

With a transformer bank connected star, if one transformer is disabled, the whole bank is practically disabled while when connected delta and one transformer is disabled, the open delta remains and 66.6 per cent of the bank's former capacity can be delivered.



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If one phase of a delta connected rotor is open, no torque can be developed since there is no closed circuit in the rotor winding.

Since most all wound rotor motors are connected star, if one phase of the rotor winding is open, a closed circuit remains and torque will be developed but reduced. Speed will also be reduced if the original load is still applied.

However, one phase of the rotor winding being out would increase the resistance of the rotor winding since one path for returning current is destroyed. This would have the effect of increasing the torque of the remaining winding the same as when resistance is inserted in the rotor of a perfect wound rotor motor creating greater slip, hence lower speed.

The unbalance torque condition results in less total torque and lower speed.—B.A.S.

A Safety Problem

QUESTION 235 — On a fly-wheel load driven by a 220 volt d-c motor, shunting the main switch results in burning out of 110 volt lamps on the under-loaded side of the 3 wire Edison system. What can be done to remind workers that they must pull the motor switch before they pull the main switch?—H.S.

A. TO QUESTION 235—I believe that you have your motor hooked up with a hot shunt field. Pulling the main switch before the motor switch will cause the lights to take the field discharge.

When you open a hot shunt field you induce a high voltage; if you have no discharge resistance for it to expend itself on, in the form of heat, then, it will find an out some place else and in your case I believe that it is the lights.

If your motor is hooked up hot shunt, then I would reconnect it as a cold shunt. Put it between the controller and the motor instead of between the controller and motor switch. I wouldn't try to remind the workers in any way.—W.J.F.

A. TO QUESTION 235 — A sign over or near the main switch reading "STOP MOTOR FIRST" could be used. An interlock to prevent opening the main switch before the motor switch is opened could be provided or a rod could be placed so that it would be in front of

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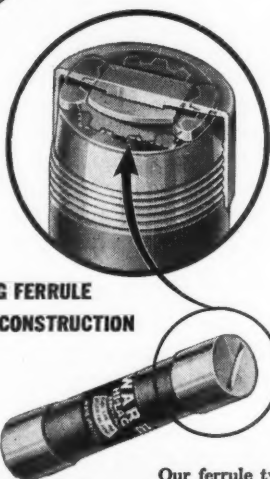
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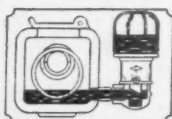
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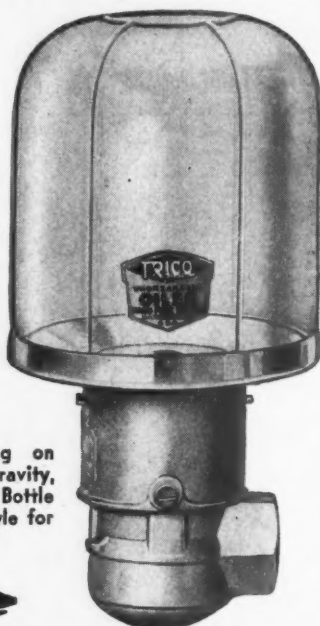
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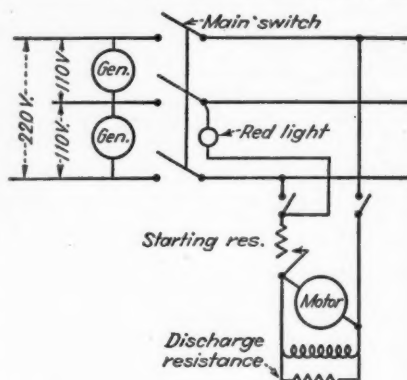
SUPERIOR CARBON BRUSHES

the main switch when the motor switch is closed.

By providing a discharge resistance across the main switch when it is opened, it would be possible to provide a parallel path for the current delivered by the motor and so the lamps would be protected.—J.E.W.

A. TO QUESTION 235—If a signal is all that is desired to remind the operator to pull the motor switch before he pulls the main switch, it would be a simple matter to install a socket with a 110 volt red lamp bulb near the main switch, one wire from which to be connected to the center line of the Edison System, at the main switch and the other wire from the socket to be connected to either terminal on the motor side of the motor switch. The light is on only when the motor is connected.

If the motor starter is the Magnetic Type wires could be run from the holding circuit of motor starter to a momentary contact push button placed

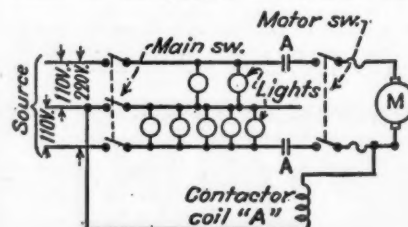


at the main switch so the motor could be disconnected from that point.

Evidently this motor is not provided with a discharge resistance across the shunt field. Since it is high induction voltage that burns the lights out when the motor is being disconnected, if a discharge resistance is installed, the motor switch could be pulled any time regardless of the position of the main switch.—B.A.S.

A. TO QUESTION 235—It is far more preferable to make the circuit controls independent of the human element than to depend upon workers remembering in which sequence switches must operate.

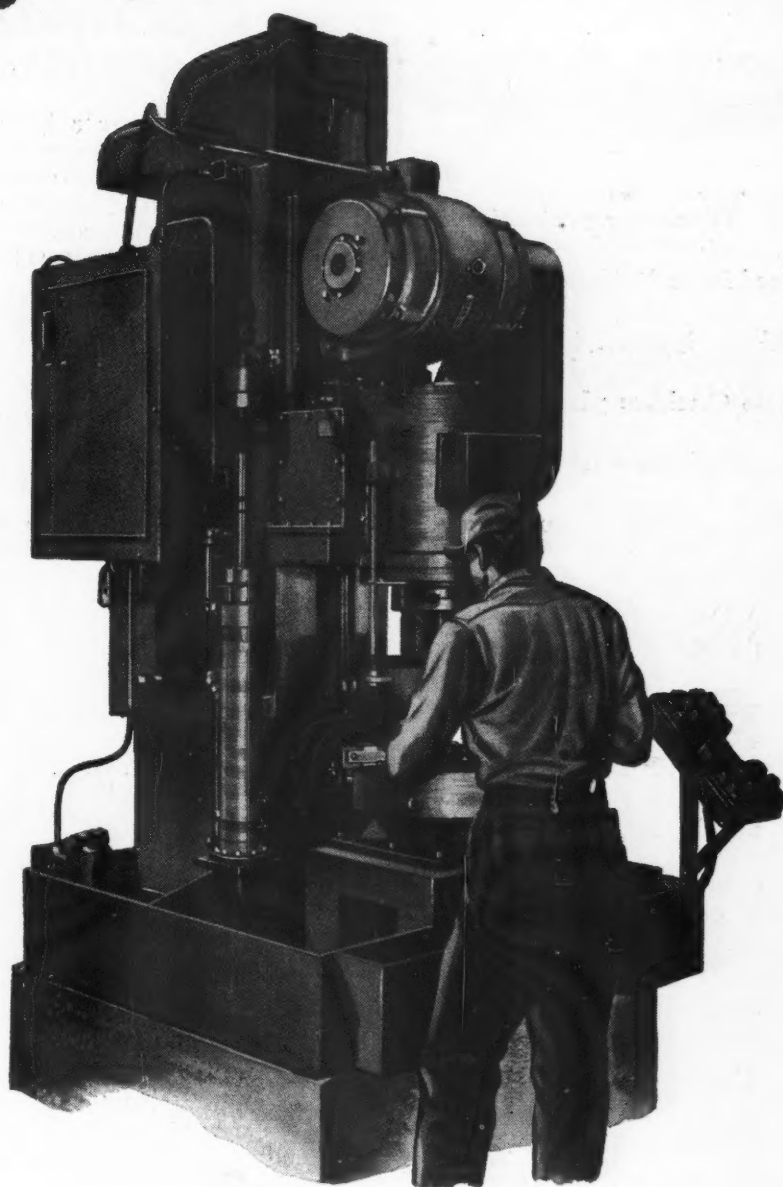
In the following diagram, a contactor of the proper horsepower rat-



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ON countless difficult jobs Fairbanks-Morse Motors have proved their outstanding qualities. However exacting the requirements, however heavy the service, users find that these motors have the efficiency and the stamina that mean economical, uninterrupted power.

You, too, can invest in Fairbanks-Morse Motors with confidence. Fairbanks, Morse & Co., Chicago 5, Illinois.



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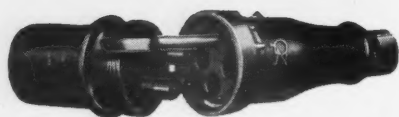
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TAKE THREE 60 AMPERE, 250 VOLT
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Wherever protection is desired for individual units of portable equipment, use these fusible type QuelArc plugs. In case of overload the unit at fault is isolated without shutting down other tools or equipment. Plugs are 3-wire 4-pole, grounded through shell and extra pole. The cast aluminum alloy housing and handle is separable for replacing fuses and has a cast brass clamping nut for easy access.

Consult your Pyle Catalog for complete listings of plug and receptacle equipment.

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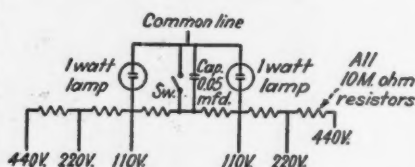
THE PYLE-NATIONAL COMPANY

1346 N. Kostner Avenue, Chicago 51, Illinois

ing is cut in ahead of the motor switch and is interlocked with the main switch so that the motor is disconnected from the line as soon as the main switch is opened, thus isolating the lighting from the main energy source and from the energy stored up by the motor because of its flywheel inertia. The contactor coil will be energized only when both the main switch and the motor switch are closed.—A.F.D.

Can you ANSWER these QUESTIONS

QUESTION T10—I have a home made phase meter or phase relationship meter. If the leads are connected to the same phase every time the right hand light will glow and when the switch is closed this light will go out



and the other lamp will light according to the directions, but it fails to work properly. Can you tell me what is wrong with it? Above is a diagram of the gadget.—C.M.

QUESTION U10—Is it possible to convert a 70 kw., 2300 volt, 3 phase squirrel cage motor into a generator, and use for a booster on a 2300 volt line which is energized?—W. H. L.

QUESTION V10 — What is the best method of obtaining about 5 kw. of 50 cycle, 120 volt power? A 60 cycle source is available to supply the frequency changing equipment. If possible the 50 cycle should be as close in frequency regulation as the 60 cycle power source.—C. P. S.

QUESTION W10—We have received at our plant many 440 volt a-c contactors and a few 110-volt a-c contactors from surplus. As our main using voltage is 230 volt three phase we cannot use these contactors without rewinding the holding coils. Can anyone give us a simple formula, as to changing size of wire and number of turns, for rewinding coils for 230 volt a-c accurately? We do not want to use transformers to operate these coils.—L. R. D.

PLEASE SEND IN
YOUR ANSWERS BY FEBRUARY 15

P A I N E Products *Do a Complete Job*



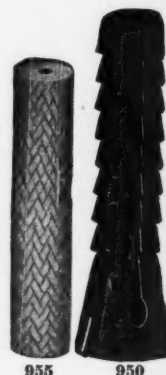
P A I N E DRILL BITS

Holes in masonry and concrete come easily with Paine Drill Bits. They cut 50 to 75% faster, assure clean, round holes for anchors, conduit or cable, are quiet in operation and hold their edge longer. Available in sizes 3/16" through 1 1/4" diams (graduated in 1/16" sizes).

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Lead and Fiber Types

Fasten electrical equipment and fixtures to tile, marble, concrete, slate, wood or wood furring with Paine Woodscrew Anchors. Simply place in hole and insert screw. No setting tool is needed and screw cuts its own thread. Available in a wide variety of sizes.



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Hang rigid or thin wall conduit . . . efficiently . . . easily with a Paine Conduit Clamp. The special offset feature holds clamp away from wall—facilitating installation and maintenance. Stove bolt is already inserted in each clamp to speed buying and installing. Guaranteed rustproof.

Do a complete job . . . a correct job . . . with these three Paine Products—the Drill Bit, the Woodscrew Anchor, and the Conduit Clamp. It is the easiest, fastest, surest and most economical way.

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★ **P A I N E** ★
FASTENING
and HANGING DEVICES



Motor Shops

Pipe Tail Conserves Insulating Varnish

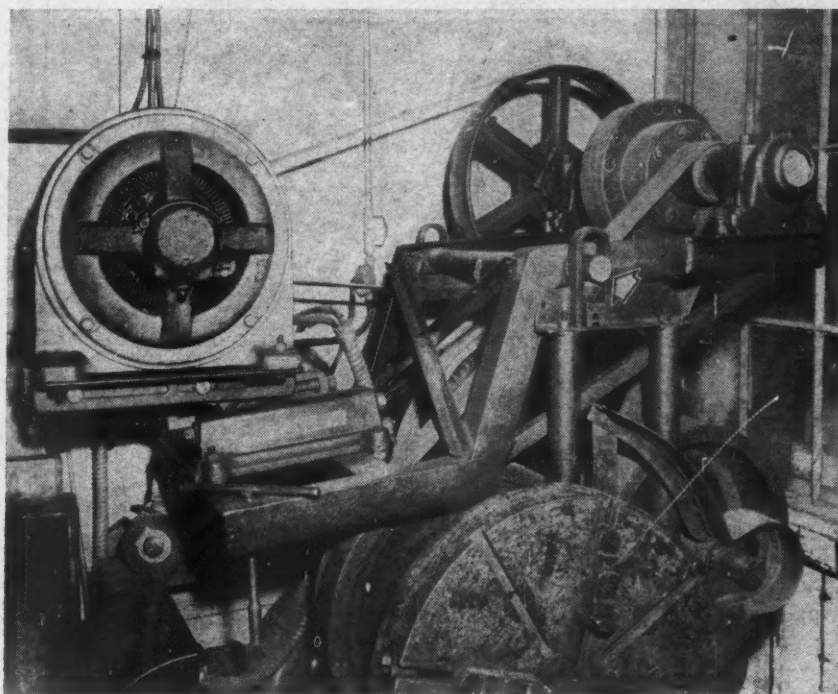
A good idea on the subject of dipping comes from the motor shop of the New England Machine and Electric Company, Pawtucket, R. I., where motors with capacities ranging up to 75 hp. are frequently rewound.

The length of the armature shafts of these large units usually makes it necessary to provide extra-size dipping tanks so that the armature windings can be completely covered by the impregnating varnish. To cover the windings, the armatures must be lowered horizontally into a tank of medium depth and a large surface area or into a vat of extra depth. Since the required volume of the tank is governed by the length of the shaft, which requires no insulating treatment, rather than by the size of the armature, a large dipping tank demands greater quantities of varnish, greater heat to maintain the desired temperature and higher resultant charges for this step in the rewinding routine.

In the shop of the New England Company, the main body of the tank has an area 42 by 48 inches and a depth of three feet. It is made of medium gauge steel with corners reinforced by angle irons. In the center of the bottom section, an 18-inch length of 4-inch pipe has been welded and sus-

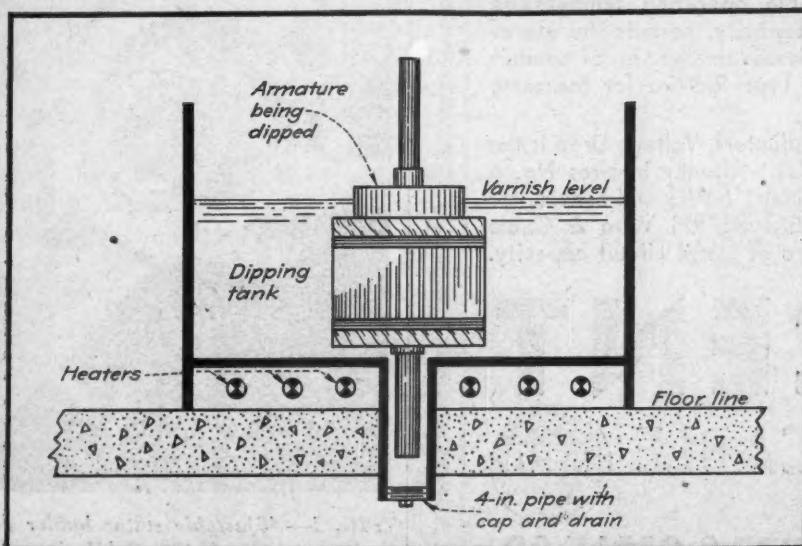
pended through a hole in the reinforced concrete shop floor. The lower extremity of this pipe is accessible from the basement and is properly capped and fitted with a drain cock.

The armature shafts are lowered into this 4-inch pipe extending below the main tank, the armature windings can be submerged to the normal bottom of the vat and a minimum amount of varnish used.



Floating Drive For Large Lathe

To machine welded end-bells, stators and other components of large electric motors, the A. W. White Electric Motor and Machine Company, Oklahoma City, uses a 42-in. lathe, an old car wheel lathe salvaged for this purpose. Motorization of the unit was accom-



Section of 4-inch pipe is welded in the center of the bottom section of dipping tank. Extending through the floor of the motor shop, the end of this pipe is properly capped and provided with a drain cock. Armatures up to 75 hp. in capacity can be dipped in varnish by placing shaft of armature in pipe tail and lowering windings to bottom of main tank.

FIG. 1—Heavy duty floating drive for 42-in. lathe. Complete assembly pivots on shaft (arrow) providing belt tension between jack shaft and lathe.

plished by designing a rocker arm drive composed of a motor and jack shaft.

An offset rectangular frame made of 3-inch angle iron forms the base for the motor (mounted to a Rockwood Drive) and the support for the jack shaft and step pulleys (Fig. 1). The frame pivots about a 2-in. hollow shaft, so positioned that the weight of the motor and base is slightly more than that of the jack shaft and pulley. This slight off-balance provides the necessary belt tension between the jack shaft and lathe pulley. Pivot shaft, securely positioned by inverted-U collars (Fig. 1, arrow) welded to a supporting frame, rests on "take-up" blocks that provide a limited degree of vertical adjustment.

CRESCENT ENDURITE Type RH

*Gives Greater Current Carrying
Capacity per Dollar of Installed Cost*

AN EXAMPLE—
200 AMP. CIRCUIT



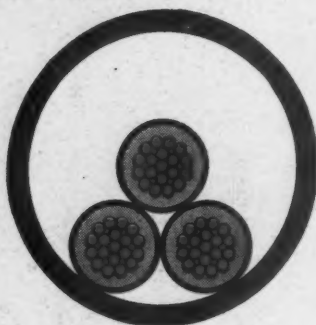
250,000 CM

TYPE R

Requires 2½" Conduit. Maximum permissible operating temperature 60° C.

For 100 ft. run cost for wire and conduit—approximately

\$159.00



3/0

TYPE RH

Requires 2" Conduit. Maximum permissible operating temperature 75° C.

For 100 ft. run cost for wire and conduit—approximately

\$116.00

Both figures are based on 330 feet of cable and 100 feet of galvanized steel conduit at PRESENT LIST PRICES. Saving shown—27%.

The superior heat resistant characteristics of CRESCENT ENDURITE INSULATION with its higher permissible operating temperature and therefore greater current carrying capacity, permits the use of a smaller size of conductor, and in most cases smaller size of conduit at less cost than would be required for Type R Wire for the same load.

For light loads requiring small sized conductors, Voltage Drop is the determining factor in choice of wire size. Usually in sizes No. 6 AWG and heavier for power circuits or No. 1 AWG and heavier for lighting circuits, CRESCENT ENDURITE Type RH Wire & Cable gives the lowest installed cost-per-ampere of useful circuit capacity.

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WIRE and CABLE



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TRENTON, NEW JERSEY

The 10 hp., 1200 rpm., 220 volt, 3-phase motor drives the jack shaft at approximately 300 rph. Step pulleys on the jack shaft and lathe provide additional speed reductions.

Adjustable Stator Holder

Considerable decrease in winding time for fractional horsepower motors has been effected in the motor service shop of A & H Electric Repair, Akron, Ohio. Reason: They are using a Motorcraft adjustable stator holder that provides for almost any working position desired. The unit accommodates split-phase, 3-phase, shaded pole, or d-c stators from fractional up to 3 hp. in size.

Simple in design and operation, the device consists of three major parts: An 18 in. cast pedestal for bench mounting; an adjustable cast yoke; a 9½ in. (inside diameter) steel ring that rotates in the yoke. Figure 1 illustrates the unit in use. The stator is securely held in the ring by screw clamp (A) and two removable metal fingers (E) which are furnished in lengths that provide 1 in., 2 in. and 3¼ in. spacing for various sized motors. The ring itself rides in two fixed slots (D) and one (B) equipped with a screw clamp. Knob (B) can be tightened to hold the ring in one position or loosened to permit rotation of the ring as the mechanic inserts coils in the stator slots. Thus, frequent shifting

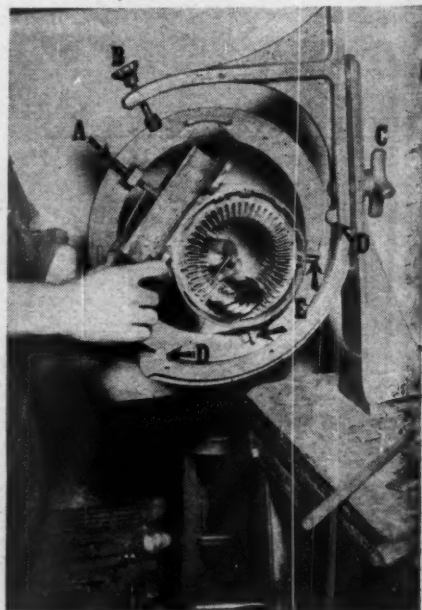


FIG. 1—Adjustable stator holder permits rotation of stator while inserting coils. Stator is held in ring by clamps "A" and "E"; ring rotates in slots "B" and "D"; knob "C" provides vertical and angular adjustment of yoke.



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EASY-TO-WORK Spang CW and Spang Lapweld . . . the finest, full standard weight types of pipe made . . . are used to make Central Rigid Steel Conduit. That's why it has strong walls, full weight and good fatigue resistance. These qualities are your assurance that Central Rigid Steel Conduit will resist crushing and that it will withstand vibration.

Both the inside and outside of Central Rigid Steel Conduit are given a permanent, elastic black enameled or hot dipped galvanized and lacquered finish. Consequently, you can depend upon Central Rigid Steel Conduit to resist severe conditions of corrosion.

But that's not the whole story.

Central Rigid Steel Conduit has a carefully prepared, smooth inside surface which enables wire to be pulled through or withdrawn fast and easy. It has an accurate circular cross section which permits cutting of clean, true threads assuring quick make-up and tight joints. Central Rigid Steel Conduit meets all the National Electrical Code specifications for moisture, vapor and dust proof requirements in hazardous locations and occupancies. And every length is inspected by Underwriters' Laboratories and bears their label of approval.

At times your jobber may not be able to supply you with all of the Central Steel Conduit you want. But keep in touch with him. He will make sure you get your share of the available supply.



*There's Tested Strength
in Every Length . . .*



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Division of The National Supply Company
General Sales Office: Grant Bldg., Pittsburgh 30, Pa.
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Threads on Central Rigid Steel Conduit are checked for length, taper and size. Only those that are accurate in every detail are passed. That's why you are always sure of tight fitting joints when you use Central Rigid Steel Conduit.

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A
RENEWABLE FUSE
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NEVER before a renewable fuse so simply constructed...
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RIGHT...
YOU CAN'T
ASSEMBLE IT
WRONG!

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TROUBLE LIGHTS • CHRISTMAS LIGHTING SETS

ROYAL ELECTRIC CO., Inc., PAWTUCKET, R. I.



FIG. 2—For making end connections on coils, yoke of holder is fixed in horizontal position. Ring holding stator is free to rotate.

of the stator—necessary with vise type holders—is eliminated.

Knob (C) permits vertical adjustment of the yoke for comfortable working height; also angular or horizontal positioning of the yoke when making end connections on coils (Fig. 2). Regardless of yoke position, the stator supporting ring can be either stationary or free to rotate whichever is desired.

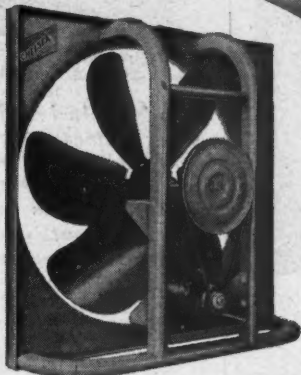
Conduit Yokes Hold Armature Shafts

Storage of armatures for future service or while awaiting repairs, varnish impregnation or delivery to customers combines compactness, neatness and safety in the motor shop of the New England Machine and Electric Company, Pawtucket, R. I.

At one end of their modern shop, in an area adjacent to dipping tanks and baking ovens and served by an overhead monorail crane, sturdy 4 by 6 inch timbers have been utilized to construct a series of 20-70-90 degree triangles, measuring eight feet along the inclined front side. Erected with varying intervals between them, these bolted frames are so spaced that the shafts of any sized armature can span the distance between them. The occasional shaft which is found to be shorter than this distance is temporarily lengthened by the use of auxiliary pipe sections which are slipped over the shaft ends. To cradle the shafts and thus hold the armatures clear of the floor, split conduit yokes have been bolted along the front timber on approximate one-foot centers. As pictured, armatures are staggered when

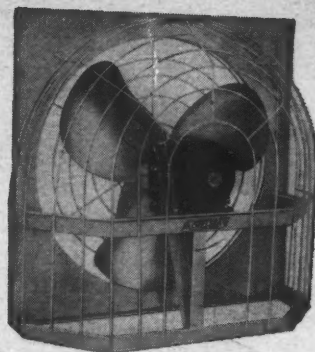
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*...provide clean, fresh
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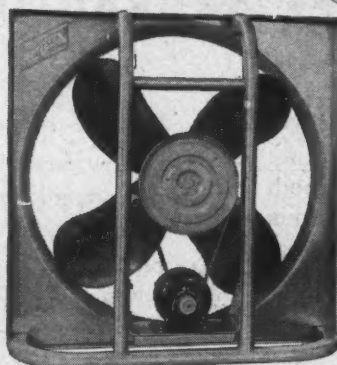
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Heavy duty ventilators for air blast action
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High air moving capacities ... Dependable, economical, ball bearing, totally enclosed motors ... Ratings up to 4900 CFM ... Front and rear guarded.



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Quiet operation combined with high air deliveries ... Rugged, streamlined construction ... Rubber cushioned against vibration. Low power consumption.

Winter or summer, Chelsea ventilating units help make the day's activity more comfortable, more healthful, more profitable. User acceptance of these efficient air movers is a direct result of Chelsea design and range of models ... a fitness for the job that makes every Chelsea fan deliver extra measures of satisfactory operation. Featured in most models are rugged, all-steel construction ... dynamically balanced blades ... efficient, cool-running motors and drives ... rubber cushioned moving parts ... Get the details on the Chelsea line NOW. Chelsea fans are in great demand; early orders mean early deliveries!

*... wherever people live,
work, play or gather!*



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FACTORIES: COIT, GROVE & OLSEN STS., IRVINGTON, NEW JERSEY



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CARRIED
AND SET UP
WHERE YOU
WANT IT**

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"Our battery of GREENLEE Hydraulic Benders consistently provides substantial savings in both time and materials on our many thin-wall conduit and bus-bar installation jobs," reports Mr. Joseph A. Pope, Executive Vice President of The Beltzhoover Electric Company, Cincinnati.

"Maintenance cost is low and the GREENLEE is easily carried and set up."

You, too, can realize important savings and speed work with a GREENLEE Hydraulic Bender "right on the job." Takes only *one man* to operate...in but a few minutes makes smooth, *accurate* bends in pipe up to 4½", rigid and

thin-wall conduit, tubing, bus-bars.

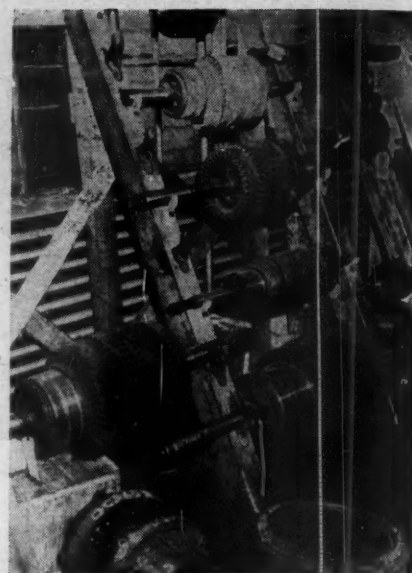
Now, when jobs are rushing you, manpower is short, get the important, *extra* help this timesaving equipment provides.

Whatever your bending job, there's a GREENLEE to do it. Get complete facts now on GREENLEE Hydraulic and Hand Benders and other time-saving tools for electricians. Write Greenlee Tool Co., Division of Greenlee Bros. & Co., 1741 Columbia Avenue, Rockford, Illinois.



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Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers



Sturdy, bolted timbers, forming triangular frames, have split conduit yokes bolted along the front side on approximate foot centers. Storage of armatures in this manner eliminates possibility of damaging equipment, improves appearance of the shop, increases the useful floor area and promotes safety.

storing, permitting maximum use of available space and minimizing the possibility of damage to the armature. The shop floor is kept free for actual repair work and the general appearance of the shop is improved.



Robert C. Frame (right) discusses rigging and installation problems with his electrical engineer, Crate Thornton. During the Pittsburgh utility strike, the Frame Electric Company was active in installing emergency generating equipment for both industrial and commercial users of power.

Answered by
F. N. M. SQUIRES and **GLENN ROWELL**
New York Board of Fire Underwriters Electrical Engineer
Chief Inspector Fire Underwriters Inspection Bureau
New York, N. Y. Minneapolis, Minn.

Questions on the Code

Location of Service Switch

Q. Our Cooperative requires a meter loop installed on a yard pole adjacent to a farm residence with a disconnect switch located below the meter. The question is where should the service entrance switch be located, in the house, that is, in the basement, on the first floor or on the second floor? We, in the past have always considered a second floor installation of the service entrance switch to not be readily accessible.—E.W.

A. The disconnect switch located beneath the meter on the yard pole is the service switch for the farm. This should be a fused switch so that it can serve as the complete service equipment.

Each building then, must be separately controlled by an enclosed externally operable switch or by a circuit breaker which can be on the pole, in the building served, or in another building (See Section 2306 of the Code). This switch does not have to be considered as a service switch so does not have to be at any particular location if installed in the house. It should be in a location readily accessible to the persons using the installation.

The above switch could be either in the basement, or on the first floor. The second floor is no place for such a switch nor for a service switch in a single family dwelling.—F.N.M.S.

Continuous Trough Lighting

Q. We are installing continuous trough lighting and are using fixtures designed with a wireway, but the local inspector refuses to permit use of this wireway unless we replace the type T conductors we are now using for circuits with type AVA or

other similar heat resisting wire. How about this, is this a requirement of the Code?—J.D.W.

A. It is assumed that you are installing fluorescent fixtures having the tube ballasts mounted in the space designed for use as a wireway. If this is the case, the inspector probably is complying with Section 3004 in refusing to accept the use of type T conductors. This section states that insulated conductors shall not be used where the maximum operating temperature will exceed that specified for the insulation involved. Type T insulation is rated as a 60 degree centigrade or 140 degree fahrenheit insulation, and in many types of fixtures the maximum operating temperature adjacent to the ballasts exceeds this, making it mandatory to use special heat resistant insulated conductors.—G.R.

Grounding for Tourist Cabins

Q. We are wiring a group of 60 tourist cabins and the question of grounding at each cabin has become quite an issue. The master service will be located in the office and store building and from there we are running three wire feeders overhead each way to serve 15 cabins. According to our interpretation of the Code, the neutral must be grounded at the master service only and should not be grounded at each cabin, but this has been questioned by the local inspector. It is approximately 360 feet from the master switch to the furthest cabin in each direction, and each cabin contains two circuits, one fused at 20 amperes supplying a two burner hot plate and one appliance outlet and the other five light and two convenience outlets. An attempt at balance is made by dividing the cabins evenly between the ungrounded conductors with a 35 ampere single pole breaker in each cabin. Does the Code require that the neutral be grounded at each cabin?—W.F.C.

A. The 1940 N.E. Code states that the neutral may be grounded under Section 2524, however, the same section in the 1947 edition which in all probability will become effective on the first of the year will require the neutral to be grounded. This revised section will read as follows: "If more than one building is served by the same service, the grounded circuit conductor of the wiring system of any building utilizing one branch circuit supplied from such a service may be connected to a grounding electrode at such building, and in case of any building utilizing two or more branch circuits supplied from such service, and in case of a building housing livestock shall be so connected."

While the present Code does not require that the neutrals be grounded, I believe it advisable to provide these grounds as they will afford definite protection especially on those cabins located quite some distance from the master service.—G.R.

Attachment Plug Caps

Q. The writer has often wondered why manufacturers are not required to polarize the ordinary two wire pin point plug cap although all approved receptacles are polarized and portable fixtures or appliances are wired in an approved manner until they reach the attachment plug.—H.J.F.

A. The reason that the manufacturers do not polarize the two wire attachment plug cap is that the National Electrical Code does not require it.

A general program of polarization was started many years ago and certain portions of our wiring systems and equipment are now required to be polarized. For instance, branch lighting circuits and permanently connected fixtures have to be polarized.



**SAVES
TIME
and
MONEY**

- TAKES HOLD QUICK!
- CUTS CLEAN!
- DRILLS FAST!
- CAN'T STALL!
- STAYS SHARP!

The Kennadrill fills a long-felt need for a rotary drill bit that cuts fast and true, and keeps its edge under the heat and abrasion of drilling in non-metallic construction materials. This new bit saves time and labor drilling holes in *all* types of masonry—brick, stone, sewer pipe, cement, etc. One contractor using Kennadrills reports: "Drilled 50 holes, 1½" deep, in glazed tile before resharpening Kennadrill. Time—40 seconds per hole."

Kennadrills take hold quickly (no starting punch required), do not chip or crack glazed surfaces, and drill through in a hurry, because their cutting edge is Kennametal—the tool metal that is far harder and more durable than hardened steel.

Kennadrills have Kennametal tips in heat-treated steel shanks. They fit any standard rotary electric drill, and are designed so that chips are ejected freely and smoothly—no binding, stalling, or danger of overloading drill motor. Available in following cutting diameters—¼", ⅝", ⅜", ½", ⅝", ¾", ⅞", and 1". Ask your jobber about Kennadrills, or write for Folder 46-5.

* Kennadrills have cutting tips of the "magic metal" of the war—cemented hard carbides known as Kennametal, that helped America's metal-cutting industry to multiply its output at a fraction of previous costs.

Distributors Wanted!

Write for particulars, telling us territory you cover.



KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.

The attachment receptacle manufacturers did polarize their receptacles but the polarization of portables is a more involved problem and has not been fully consummated.

This problem of polarization is tied in very directly with grounding, which is also involved. However, a special committee of the Electrical Committee of the NFPA has been appointed to study this very subject and will undoubtedly have a report before very long which will have an important bearing on the whole matter. — F.N.M.S.

Residential Wiring

Q. We have been offered the contract for the wiring of a group of veterans' houses and will take it if we can use black conduit for the service. There apparently is nothing in Article 346 that would prohibit its use, but we will appreciate your views on this.—K.N.

A. The Code under Section 3019 limits the use of enamel protected ferrous conduit and fittings to indoors and then only where not subject to corrosive influences. A dwelling occupancy could not be considered corrosive, but technically the service conduit if outside could not depend upon an enamel finish for protection from the elements. Under Section 2331 in the fine print note, you will find that the Code Committee recommends the service should not be run within the hollow space of frame buildings. Therefore the enclosure of this black enameled service conduit within the wall would protect it from the weather but it would also be considered poor practice from the fire hazard point of view by the Code. However, this would not be a Code violation.—G.R.

Overhead Wiring

Q. Must the overhead wiring between a dwelling and the garage be of the weatherproof type? We are unable to find any definite ruling within the Code for wires between buildings as the Code apparently covers only festoon lighting and open wiring on insulators on the outside of a building, but the local inspector is insisting that we use weatherproof for these overhead spans.—P.H.

NO MORE STARTER SWITCHES

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NO MORE STARTER TROUBLES!

Guth Quick-Liter

TRADE MARK

FLUORESCENT LIGHTING THAT'S SIMPLE!

Ordinary Fluorescent Fixtures, fitted with conventional Starter Switches, frequently result in confusing, high cost maintenance. When Lamps stop burning, it is often very difficult to determine whether the Lamp or the Starter needs replacing.

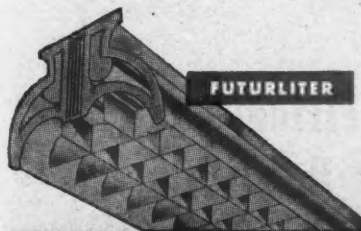
With GUTH Quick-Liters, there are no Starter Switches—so there are no questions! When a Lamp goes out, it's a dead Lamp! Result—easier, quicker, more certain maintenance. Also, much longer usefulness—

since each Lamp supplies illumination to the end of its life!

Check the many additional advantages of GUTH Quick-Liters:—light at the flick of a switch—start and operate at temperatures as low as 0° F, or on low or irregular voltage—mass-produced for lower initial cost and more economical installation cost. These advantages readily explain why Quick-Liters are the final word in Good Fluorescent Illumination.

WRITE TODAY FOR INTERESTING MATERIAL
ON THE FEATURES OF GUTH QUICK-LITERS

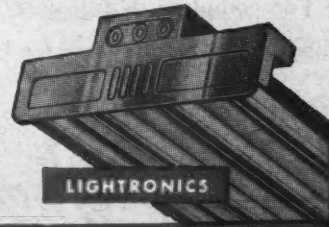
**MANY ATTRACTIVE, EFFICIENT GUTH FLUORESCENT LUMINAIRES
MAY BE EQUIPPED WITH QUICK-LITER BALLASTS**



FUTURLITER



ARISTOLITE



LIGHTRONICS

Leaders in LIGHTING Since 1902

Guth

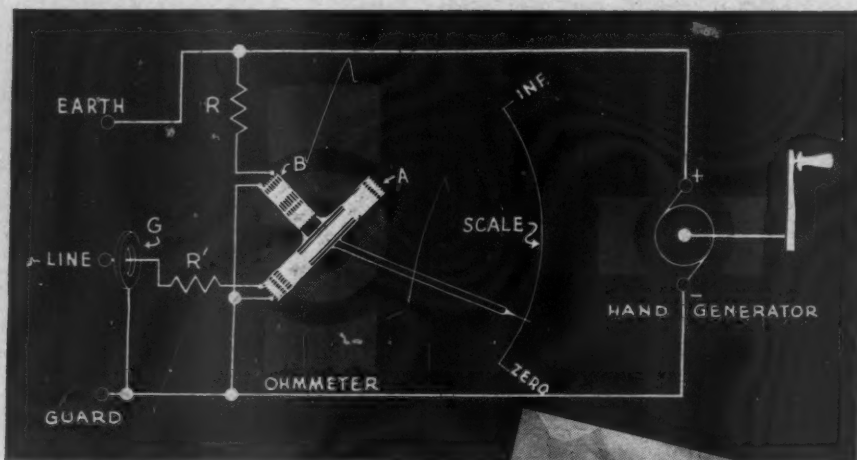
★ ★ ★ THE EDWIN F. COMPANY ★ ★ ★

2615 WASHINGTON AVE.

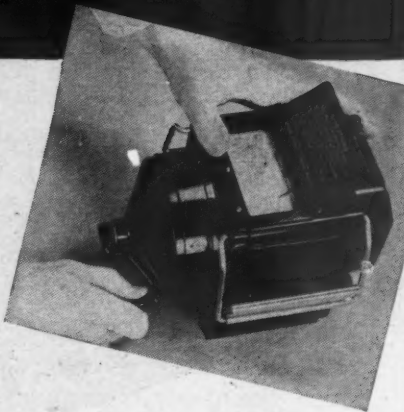
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Here's why—

"MEGGER"* Insulation Testers are always dependable—



In what we term a cross-coil true ohmmeter, two coils are mounted in fixed relation to each other on the same pivot-and-jewel moving system in the field of a permanent magnet. "Current" flows in coil A and "potential" in coil B, and they are connected so that their respective torques oppose each other. Since there are no control springs, the opposing coils give a true ratio of E/I , and ohms (or meg-ohms) are indicated by a pointer over a scale. The readings are independent of the voltage of the hand-driven d-c generator, because any change in the voltage affects both coils in the same proportion.



The "Megger" instrument is simplicity itself. The circuit diagram shows all elements—hand-cranked generator, fixed resistance coils and ohmmeter with pointer and scale. Nothing more is needed and nothing could be simpler. In making resistance tests, you merely connect leads from the instrument to the apparatus or circuit under test, turn the crank for a few seconds, and read the insulation resistance directly on the scale.

Power generation and distribution practice has dictated certain standards of quality and performance that every piece of electrical equipment is expected to meet. "Megger" insulation testing instruments have been and will continue to be built in conformity with these high standards.

For complete descriptions and applications of all types of "Megger" Insulation Testers write for Catalog 1685-EC.

*Trade Mark U. S. Pat. Off.

James G. BIDDLE CO.
ELECTRICAL & SCIENTIFIC INSTRUMENTS
1316 ARCH STREET • PHILADELPHIA 7, PENNA.

A. The 1940 Code does not specifically mention overhead runs between buildings. However, it was intended that Section 7302, which stated that either rubber or weatherproof insulated conductors might be used, would include such overhead wiring. The 1946 edition will clarify this requirement by stating in Section 7301 that this article shall apply to wiring located on private or public premises, attached to the outside of or run between buildings or structures. Then under Section 7313 permission is granted to use rubber covered, thermoplastic or weather-proof conductors for such runs.—G.R.

Wiring for Dry Cleaning Plant

Q. We plan to wire a dry cleaning plant which will be located in a mercantile building now being remodeled. The dry cleaning equipment which will be used is of the approved type and the owner claims that the solvent he will use is also approved. We have examined the equipment and were surprised to find that the motors driving the machine were not of the explosion-proof type. Our local rules have required special wiring for dry cleaning plants, so there is some question as to whether we should use explosion-proof, vapor-proof or ordinary equipment. Any suggestions you may offer concerning the proper method of wiring for this cleaning plant will be appreciated.—K.N.

A. If the dry cleaning equipment, including the dry tumbler or box, are approved by the Underwriters' Laboratories, Incorporated as either a Class 3 or Class 4 device and the cleaning solvent used is of the type approved for use in the type of unit used, the wiring may be ordinary. If the solvent used in a Class 4 unit is combustible or if the solvent used in a Class 3 unit has a flash point below 138.2°F, it is possible that part or all of the wiring installation should be of the explosion-proof Class 1 Group D type.—G.R.

Electrical Equipment For Hospitals

Q. May ordinary electrical equipment be used in the delivery rooms of a maternity hospital when

4 REASONS WHY you should sell Lighting Maintenance Service

1 It's a big, profitable business! Most industrial and commercial users of fluorescent lighting are live prospects for Certified Lighting Service. Dirty fixtures, inoperative lamps, faulty starters and transformers can cause as much as a one-third loss in lighting efficiency.

2 It's a "wedge" for future lighting orders! Your maintenance contract keeps you in constant touch with the customer—gives you preferred consideration when a new lighting job is planned.

3 It's a stable source of income! In good times and bad, you can count on lighting maintenance service as a steady source of sales. It helps to keep you in the black!



4 It's a credit to your company! By adding maintenance service, you can make your organization the Lighting Headquarters of your community. It broadens your field of profit opportunity . . .

HOW GENERAL ELECTRIC CAN HELP YOU

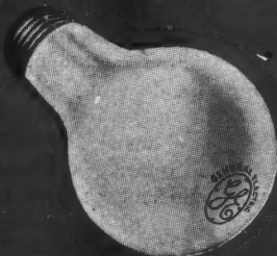
If you've attended G-E's special Planned Store Lighting meetings, you know how completely General Electric is ready to help you get started in Lighting Maintenance Service. This help includes tips on solicitation, direct mail, contracts, costs, personnel training—and, of course, supplying fluorescent lamps with the G-E monogram. For full information, call your nearest General Electric Lamp office.

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THIS EMBLEM on your window, stationery and trucks will remind customers that your company offers them complete lighting service backed by the General Electric name and facilities.

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Every electrician and contractor worth his salt watches the little things—like fittings . . . because they figure **BIG** on wiring jobs done *right*! That's the reason for GEDNEY care in turning out fittings that help you come out "on top".

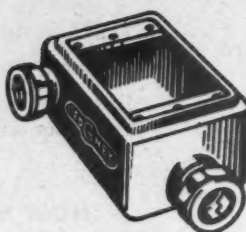
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Conveniently packaged and clearly labeled for instant selection of the proper size and type for your job. UL approved. Look for the familiar box with the all-over GEDNEY trademark pattern and sturdy metal edges.

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GEDNEY ELECTRIC CO.

FOUNDRY, FACTORY & SHIPPING POINT: TERRYVILLE, CONN.
RKO BLDG., RADIO CITY, NEW YORK 20, N. Y.



only nitrous oxide is used as an anesthetic?—P.E.

A. If only nitrous oxide is used, the answer would be yes, but I believe that if you investigate further you will find other anesthetics are also used on certain occasions. In the smaller hospitals ether is commonly used for physical reasons on a small percentage of the patients. In larger hospitals mixtures of ethylene are often used for the same reasons. So unless the hospital staff can assure you that there is no likelihood of combustible anesthetics being used, it will be advisable to use only the Class 1 Group C type of equipment within these rooms. Electrical equipment located seven feet or more above the floor may be other than explosion-proof provided an independent ventilating system connected only to those rooms assures 20 air changes per hour while such rooms are in use.—G.R.

Second Floor Service Switch

Q. It is not clear in our mind as to whether or not a service entrance switch or disconnect switch may be located on the second floor of a single family dwelling.—E.W.

A. The National Electrical Code does not prohibit locating service entrance switch on the second floor of a single family dwelling provided it is readily accessible. However, such practice is frowned upon as is evidenced by Official Interpretation No. 279 issued August 9, 1946, as quoted below:

"Question: Is it the intent of Article 230 of the National Electrical Code that a bedroom be recognized as a readily accessible location for service equipment?"

"Finding: The Interpretation Committee does not find that the Electrical Committee considered the possibility of locating service entrance equipment in a bedroom in a private home; therefore, as to intent an affirmative answer cannot be made."

You will note that in the above interpretation they are dealing with a bedroom whether on the first or second floor of a dwelling and that they did not come out and give a clear cut "Yes" or "No" answer.

This interpretation would give an inspector sufficient ground to reject the installations of service equipment in a bedroom but not sufficient ground if the service equipment was located in some other room in an accessible location.—F.N.M.S.

In the News

Conference Studies Farm Electrification

The opening gun of a concerted national effort to promote full electrification and "industrialization" of the nation's farms was fired at the first National Farm Electrification Conference in Chicago's Hotel Sherman, Nov. 7-8. Sponsored by some 13 participating organizations interested in farm electrification (REA conspicuous by its absence), the two-day session drew more than 350 representatives of farm groups and press; educational institutions; power suppliers; manufacturers, distributors and dealers of electrical equipment; electrical contractors; trade and professional societies.

Conference chairman George W. Kable, editor, *Electricity on the Farm*, keyed the forum when he revealed that program emphasis would be on "the profitable utilization of electricity on the farms." Hi-line extensions to farms are being taken care of by private utilities and REA, he added, noting that the big problem now is to go out and show the farmer how best to use electricity in the "farm factory" and find out just what type of equipment is needed.

The key man to reach out and educate the farmer in the use of electrical production equipment is the electrical specialty dealer, asserted Charles G. Pyle, managing director, National Electrical Wholesalers Association. He urged the electrical industry to assist such dealers with sales training courses, sales manuals, factual data, advertising and promotional materials. Wholesalers—the direct links to the dealers—should set up farm electrification departments with complete lines of farm production materials, he declared.

Through their numerous contacts, utilities can effectively supplement the work of existing agencies in promoting efficient use of electricity. Utilities should have agricultural development departments entirely separate from commercial departments and devoted entirely to agricultural interests, said C. H. Leatham, vice-president, Monongahela Power Co., Fairmont, W. Virginia. Such programs would benefit both the farmer and power supplier.

Research in farm electrification—an

integral part of agricultural research—has been carried on for over twenty years at Purdue University, said H. J. Reed, Dean of the College of Agriculture at Purdue. Hundreds of practical applications now in use have resulted from this program, he added. Such research—including study of agricultural production requirements, establishment of equipment designs to mechanize specific farm tasks, actual development of needed equipment, and utilization studies of the machinery—is aimed at reduction of time and labor and increased farm production. Resultant applications are particularly important in areas where poultry, dairy, beef and pork production are principal farm enterprises, he asserted. Industry research agencies—particularly those of an applied nature—have an important place in solution of the many problems and better and more efficient results might be obtained through industry cooperation with State and Federal agencies.

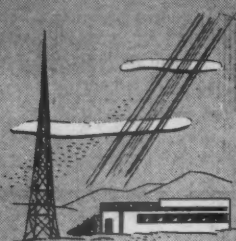
Other speakers representing educational institutions and the U. S. Depart-

ment of Agriculture outlined their activities along the lines of farm electrification training of vocational, in service, college agricultural and home economics students. Speaking for the American farmer, Dr. R. B. Corbett, secretary-treasurer, American Farm Bureau Federation, Chicago, told the conference that the average farmer is cognizant of what electricity can do to raise his standard of living. The present problem is to get new electrical developments into use on the farm, he added. To this end, his organization has established, on a national level, an over-all committee to work on the problem. The Federation is also encouraging formation of State committees composed of representatives of farmers, power companies, manufacturers and other interested groups to work closely with coordinated farm agencies in the promotion of complete farm electrification, he revealed.

Surveys indicate that farmers expect to invest, in the next five years, some \$500,000,000 in wiring and \$2,500,000,000 in farm electrical equip-



"Since when does it take three hours to put in a new fuse?"



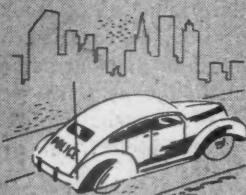
RADIO STATION STANDBY



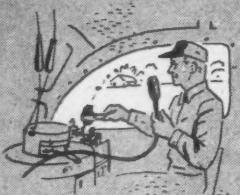
MOBILE RADIO UNITS



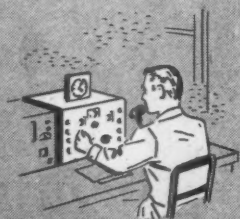
GEOPHYSICAL SURVEY



MUNICIPAL SIGNAL STANDBY



RAILROAD RADIO



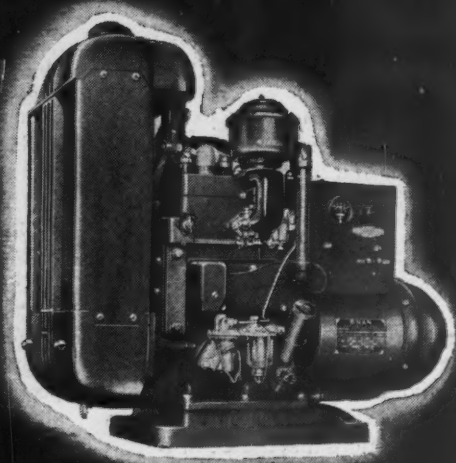
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for
Electronics Uses



Onan Electric Plants are completely self-contained, dependable power units built in a wide range of sizes and standard voltages.

Lightweight, one or two-cylinder, air-cooled models offer the maximum in portability for many applications. Portable A.C. models—350 to 3,000 watts; portable D.C. models—600 to 5,000 watts.

Although widely used for intermittent service as standby units, Onan two, four, and six-cylinder water-cooled plants are built for continuous heavy-duty operation . . . stationary or mobile. A.C. models—3 KW to 35 KW; D. C. models—3.5 KW to 10 KW.

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ONAN Electric Plants are available in many sizes and models. ALTERNATING CURRENT: 350 to 35,000 watts in all standard voltages and frequencies. DIRECT CURRENT: 600 to 10,000 watts, 115 and 230 volts. BATTERY CHARGERS: 500 to 3,500 watts; 6, 12, 24 and 32 volts.

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ment and household appliances—an entirely plausible situation when one considers the high farm income (28 billion dollars in 1946) and the fact that present "cost of living" rises will be slow in reaching the farmer (he supplies his own food and living essentials).

That the farm wife will be a considerable factor in the home appliance market was indicated by Miss Gertrude Dieken, editor, *Farmers Wife Section, Farm Journal*. The cooperative farm wife is worth exactly \$69,000 to her husband in his business, Miss Dieken revealed. The former should relieve his wife—through electrical appliances and aids—of as much of her household chores as possible to cash in on this valuable "cooperativeness." Farm equipment manufacturers have neglected to sell home appliances in terms of the indirect results they will have on increasing farm production, Miss Dieken asserted, adding that proper use of electricity can revolutionize living for the entire farm family.

With a market of the size indicated, manufacturers are naturally interested. Indications of this interest were presented by F. T. Whiting, vice-president, Westinghouse Electric Corp.; and C. H. Lang, vice-president, General Electric Company. Emphasizing the cold bare fact that farm use of electricity has not increased in the same degree as availability of power, Mr. Whiting pointed to the vast educational job to be done by the electrical industry and other agencies concerned with improving farming standards. He suggested the formation of a permanent national association whose activities would be devoted entirely to this subject; whose function would be that of a clearing house for the collection and dissemination of information designed to help the farmer utilize electrical equipment efficiently.

Manufacturers, like other agencies, can accelerate their activities and get better results through less duplication and more joint effort with programs developed through better understanding and planning, according to Mr. Lang. As an example of what his company is doing, Mr. Lang presented the movie "More Power to the American Farmer" which outlines a three-prong campaign based on product, point of purchase and promotion.

Regardless of what efficient equipment the farmer may employ to secure complete and profitable electrification, its successful operation depends upon a good wiring installation, Wm. A. Ritt, secretary-manager, North Central Electrical Industries, Minneapolis, told the conference. When planning farm wiring, the average farm must be considered as an industrial plant—a

REMEMBER THE TRAGIC

Iroquois Theatre Fire?

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This was NEWS in the early days of TOLEDO LEADERSHIP in pipe tools

Nearly 600 people trampled to death in eight minutes—that was the terrible toll when the new Iroquois Theatre burned in Chicago, December 30, 1903.

Cause of the fire was an electric arc light backstage, located too near the scenery. Failure of the asbestos stage curtain

to come down more than part way caused billowing smoke to surge over the audience and create panic. Most of the dead had been trampled in the mad rush to exits.

All this was nearly half-a-century ago—at the time when TOLEDO Pipe Tools were first being produced. News about these tools didn't make front-page headlines—but in the trade, it didn't take long for the word to get around that Toledo Threaders did the job *better, faster and easier*. The Toledo Pipe Threading Machine Company, Toledo, Ohio. New York Office, No. 2 Rector Street Building.



3-WAY THREADER—lightest, smallest and easiest to operate of all 3-way tools! No. 30 threads $\frac{1}{8}$ " to $\frac{1}{2}$ " pipe, weighs $4\frac{1}{4}$ lb. No. 31 threads $\frac{1}{2}$ " to 1" pipe, wt. 7 lb.

"TOLEDO"

TOLEDO
PRECISION PIPE TOOLS

Beat

THE LEAD SHORTAGE *with* ANHYDREX CABLES....

All available indications point to the fact that lead for cable coverings will be short for the next year at least. But this lead shortage shouldn't unduly upset you for ANHYDREX Cables with a hard service rubber jacket will give you the dependable service you want without many of the difficulties that are inherent in the use of a lead sheath.

Simplex-ANHYDREX Underground Cables can be installed directly in the ground or they can be used in ducts. They are not subject to electrolysis or corrosion. Acid or alkaline soils have no effect on them. Sheath currents resulting in galvanic action cannot occur with a rubber jacket.

Simplex-ANHYDREX Underground Cables were the first to be offered with a low water absorption insulation and a hard service rubber jacket for use underground, without ducts.

Beat the lead shortage by buying and installing Simplex-ANHYDREX Underground Cables. A new ANHYDREX Underground Cable book is ready. We'll gladly send you a copy on request.

Simplex-WIRES & CABLES

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production and processing plant for food, feed, seed, textile materials and products, he added, pointing out that the greater the degree of processing performed on the farm, the greater the return in farm income. With the increased use of electrical equipment of higher current capacity, farm wiring standards established as recently as 10 years ago have already become inadequate for some farms, he cautioned.

The crying need for farm wiring systems today is electrical adequacy including larger service entrances, heavier feeders to farmstead buildings and "production" motors, more circuits and more attention to balancing the electrical load, Mr. Ritt revealed. Best assurance of efficient operation of farm electrical systems lies in consulting an electrical contractor. *"There is no substitute for experience backed by real knowledge in the hands of a reputable electrical contractor,"* Mr. Ritt asserted noting that aggressive and constructive steps have been taken in many areas to encourage competent contractors to become farm wiring specialists. Complete cooperation and coordination among all those concerned is necessary to secure improved farm wiring standards, he concluded.

After securing an over-all picture of farm electrification activities now in force, and the tremendous job that lies ahead, the delegates voted unanimously to make the National Farm Electrification Conference a permanent annual event. The next conference will include an exhibit of equipment and educational literature.

Officers elected to plan and supervise the next conference are: Chairman—Hansel Schenck, Indiana Farm Bureau, Indianapolis; vice-chairman—George W. Kable, editor, *Electricity on the Farm*, New York City; secretary-treasurer—Russell Gingles, NEMA.



Father and son combination at Wayne Electric Company, Fort Wayne, Ind., motor repair shop. Walter Kayser (left) is shop foreman while his dad John Kayser (right) is a partner in the firm.

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Orders are being filled as quickly as possible but materials are still scarce. We suggest that you anticipate your requirements a little farther ahead than you normally would.



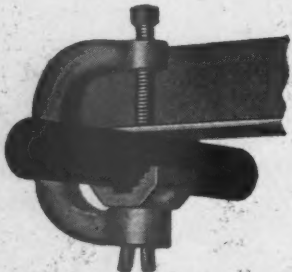
**No. 284 Nozzle with
No. 200 Cover Plate**

You'll like this Duplex Receptacle Nozzle which covers with $\frac{1}{2}$ " or $\frac{3}{4}$ " Brass Pipe Extension.



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**No. 470 "Latrobe"
Pipe or Conduit Hanger**

Convenient and dependable—for hanging pipe or conduit $\frac{1}{2}$ ", $\frac{3}{4}$ " to 1" to steel beams up to $\frac{3}{8}$ " thick.



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The iron body has $\frac{3}{4}$ " round Brass Cover plate. No. 208 Receptacle and No. 207 Bell Nozzle.



**Bull Dog Insulator
Support**

Ever ready and dependable for fastening porcelain or glass Insulators to exposed framework.



Keystone Fish Wire

Quality you will find fault with—Tempered right—Ten sizes.

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Council Studies State License Law

In an effort to relieve the acute shortage of licensed journeymen electricians which undoubtedly will exist for the next two years, the Legislative Committee of the Minnesota Electrical Council, Inc., recently met to study recommendations for amending the existing State License Law. The committee is working at top speed to have their amendments in readiness for the next session of the State Legislature scheduled for March, 1947.

Among the recommendations now up for consideration of members and other interested groups are:

1. Provision to give an applicant for a journeymans license, who has completed the full course of an accredited trade school, full credit for the calendar school years to apply against the four-year experience requirement for a journeyman's examination; other applicants to be given full credit in terms of months for shorter periods (of three months or more) in accredited trade schools.

2. Permission for an applicant with at least two years of experience in one or more special classes of electrical work (farm wiring, house wiring, etc.) to apply for a *Limited Journeymans License*—the examination and license fee to be the same as that for journeyman license. Upon successful completion of the exam, the applicant is granted the limited license for one year with renewal privilege extended for a second year. This is an *emergency measure* which would expire at the end of two years. At that time the holder of the limited license would have to pass the regular journeymans examination or revert to his former apprentice status to finish his training in other types of work.

3. Provision for applicants for regular journeymans license, who have proved four-year experience but fail to pass the exam on first try, to be issued a permit to work as a journeyman until they retake the exam (waiting period now six months). Opinion on this question is that majority of journeymen applicants failing to pass exam on first try are turning out work satisfactory to employer who, after all, can be held responsible for their performance.

4. Elimination of the Notary's acknowledgment on the affidavit form and substitution of a perjury-penalty statement; change in certain wording of law to make enforcement more effective.

5. Increase in master electricians (to \$15) and other license fees (increase of 50 cents) to permit expansion



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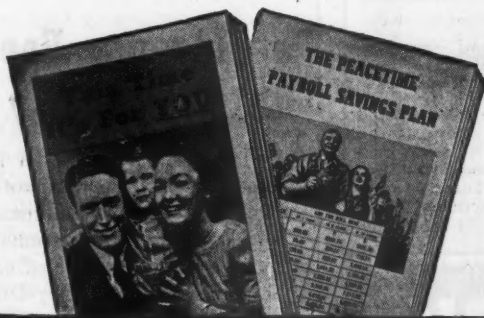
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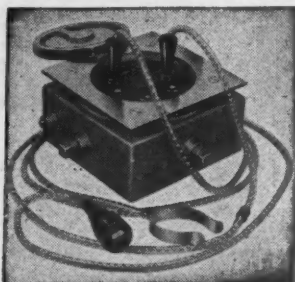
ELECTRICAL SPECIALTY ITEMS FROM CANNON ELECTRIC

ELECTRO-STATIC GROUNDING INTERCOUPLER



Installation of the Grounding Intercoupler in one of the operating rooms of the Monte Sano Hospital in Los Angeles.

... eliminates the danger of electro-static explosions of hydro-carbon gases in hospital operating rooms. The box is installed in the floor under the operating table, with provisions for grounding to a live water pipe. Chains have plug ends which connect to the box insert having $\frac{1}{2}$ Megohm resistors. The other ends of chains may be attached by various means to doctor, patient, attendant, equipment.



Type "HG" with cover plate open showing two bead chain assemblies.

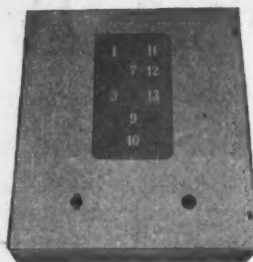
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Encased in an enameled steel cabinet, Visual Annunciators are furnished in standard sizes having from 4 to 100 lamps. Originally designed for hospitals, this equipment has been adapted to factories and plants.

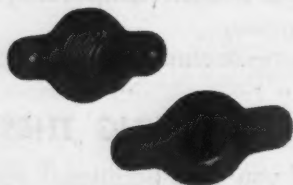


(Left) Three annunciators in a cigar factory to indicate operators' requirements for binders, fillers and wrappers.

(Right) Standard Visual Annunciator.



FS-3 FIXTURE STUD



The FS-3 "No Bolt" Fixture Stud is made of aluminum alloy for $\frac{1}{8}$ " pipe thread; vertical test breaking point of 600 lbs. Tested to 27° angle with 20" pipe. Torque test 300 to 447 inch pounds. Locknuts may be furnished at a later date. Ask for FS-3 Bulletin.



Cannon Signal Systems Catalog covers the signal line of equipment and includes Architect's Typical Specifications and comparative catalog numbers. Write Dept. A-231 for a copy.



The C-46-A Condensed Catalog contains the majority of prices and fittings and equipment manufactured by Cannon Electric. Write Dept. A-231 for a copy.



CANNON ELECTRIC DEVELOPMENT COMPANY

3209 Humboldt Street, Los Angeles 31, California
Canada & British Empire — Cannon Electric Co., Ltd., Toronto, Ontario • World Export Agents (excepting British Empire) Frazer & Hansen, 301 Clay St., San Francisco 11, Calif.

of one field representative and adequate compensation for the State Board of Electricity.

These submitted recommendations are to be studied with those of other groups in an effort to arrive at suitable amendments of the present law.

San Diego Electrical Code Amended

San Diego's city council has amended its electrical and plumbing code to permit home owners to do their own electrical and plumbing installations. The change was brought about in an effort to hasten the home building program after prospective home owners protested that construction on new homes was being held up because only master plumbers were allowed to install plumbing in buildings.

Under the amendment, persons wanting to do their own plumbing and electrical installations may do so provided they pass an examination, agree to do their own work, pay extra fees for any extra inspections necessary and apply for a permit not more often than once in two years.

Overton Heads Southeastern NISA

John W. Overton, Electric Motor & Repair Company, Richmond, Va., was elected president of the Southeastern Chapter, NISA at a recent meeting of that group. Assisting him in official capacities are: vice-president—J. E. Jenkins, Armature Winding Co., Charlotte, N. C.; and secretary-treasurer—Howard A. Lilly, Tampa Armature Works, Inc., Tampa, Florida.

No License Fees For Oklahoma City

The city of Oklahoma City, Oklahoma has been permanently enjoined from collecting license fees, or requiring bonds or examinations from electricians working on local construction. The order was issued by District Judge Lewis R. Morris, who ruled that under state law, electricians must satisfy all three of these requirements and the city cannot duplicate these acts. However, he ruled that the city may still require the electricians' work to be inspected and may charge a fee to do so.

EEL Sponsoring Lighting Program

An industry-wide Planned Lighting Program, which will provide electric utility companies with the most comprehensive promotional and educational campaign ever aimed at increasing the use of better lighting in the five major markets—residential, store, school, office and industrial—has been authorized by the board of directors of the Edison Electric Institute.

A sales plan book, outlining suggested procedures, will be prepared for each of the five lighting markets mentioned above, and will be backed up by a complete line of promotional aids.

BOOK REVIEWS Electric Motor Repair

Combining both text and over 900 illustrations, *Electric Motor Repair* covers the step by step procedure for actual repair work on all types of commonly used electric motors. It will be of interest and value to anyone who has problems pertaining to trouble diagnosing, troubleshooting and repair of electric motors, right down to completely detailed data on how to re-wind motors.

The book is divided into two parts. The first part covers theory, and is held to the bare minimum necessary to an understanding of the practical side of repair work. The second part consists of illustrations and diagrams, designed to supplement the text, and to outline in clear fashion all steps for repair of the various types of motors from the big ones used in industry to the fractionals in everyday use in homes and offices. Both alternating and direct-current motors are covered fully, as are mechanical and electronic motor control systems and synchronous motors and generators.

A unique feature of this book is its two-section binding, which allows it to lie flat on the bench for quick reference. The text is in the right hand section, with diagrams in the left. Thus, both text and corresponding explanatory illustration can be seen at the same time, making instruction rapid and accurate.

The author of *Electric Motor Repair* is Robert Rosenberg, B. S., instructor in armature winding and motor repair at Brooklyn High School of Specialty Trades, New York City. The book contains 570 pages, and is 6½ x 9 inches with two spiral binders (one for each section). Price is \$5.00. It is published by Murray Hill Books, Inc., New York City, New York.



**FOR PROFIT NOW AND
LASTING GOOD WILL . . .**

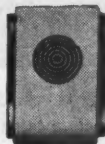
recommend and install

FARADAY SWEET-TONED CHIMES

HERE is a line of quality chimes you'll be proud to recommend and install—because they're styled in eleven beautiful, colorful models to harmonize with any decorative scheme—and because they're engineered for many years of positive, trouble-free action.

Tubular Faraday chimes have the new, exclusive "tone crown" tube hangers (all metal—no strings) which assure richer tones and a minimum of swinging. And, as you know, Faraday chimes are widely advertised in the best-read national magazines, so you'll find ready acceptance for them among your customers. Fair trade prices, \$3.95 up.

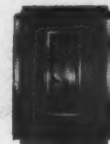
Write today for full information!



The Savarin



The St. George



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ELECTRIC CORPORATION
ADRIAN, MICHIGAN

The Ambassador

The Washington

MAKERS OF FARADAY BROILMASTER, PLUGMASTER & SIGNALS

Now Ready

New, descriptive

Bulletin No. 1246

Write for it

Illustrating the latest and
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SORGEL AIR-COOLED **TRANSFORMERS**

A size and type for every purpose

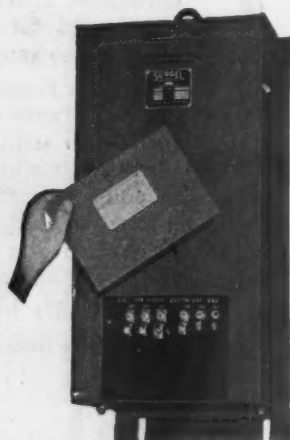


50 KVA. Single phase.
Floor Mounting Type.
With cover of connection compartment
removed, showing solderless terminals.

¼ KVA to 1000 KVA.

All Voltages

Single phase
and poly-phase



15 KVA. 3-phase.
Wall mounting type.
Showing connection
compartment with
solderless terminals

SORGEL ELECTRIC CO., 836 W. National Ave., Milwaukee 4, Wisconsin
Pioneers in the development and manufacturing of Air-Cooled Transformers

DATES AHEAD

American Institute of Electrical Engineers
—Winter Convention, New York, N. Y.,
January 27-31, 1947.
National Electric Sign Association—Con-
vention and equipment exhibit, Congress
Hotel, Chicago, Ill., February 3-5.
Indiana Chapter, I.A.E.E.—Indianapolis,
Indiana, Feb. 6-7.
National Association of Home Builders—
Convention and exhibit, Stevens Hotel,
Chicago, Ill., February 23-27.
National Electrical Manufacturers Asso-
ciation—Edgewater Beach Hotel, Chi-
cago, Ill., Week of March 2.
North Central Electrical Industries—All-
Industry Convention, Hotel Duluth, Du-
luth, Minn., March 17-19.
National Industrial Service Association—
Annual Convention, Hotel Statler, De-
troit, Mich., March 31, April 1-2.
Midwest Power Conference — Palmer
House, Chicago, Ill., March 31, April 1-2.
National Association of Corrosion Engi-
neers — Annual convention, Palmer
House, Chicago, Ill., April 7-10.
National Electrical Wholesalers Associa-
tion—Annual Meeting, Hotel Traymore,
Atlantic City, N. J.; May 4-9.
National Plastics Exposition—Stevens Ho-
tel, Chicago, Ill., May 5-11.
National Electrical Manufacturers Asso-
ciation—Special section meetings, The
Homestead, Hot Springs, Va., June
22-26.
National Electrical Contractors Associa-
tion—Annual meeting, San Francisco,
Calif., September 8-10.
2nd International Lighting Exposition—
Hotel Stevens, Chicago, Ill., November
3-7.

Manufacturers News

HERBERT METZ APPOINTED GRAYBAR DISTRICT MANAGER

Herbert Metz has been appointed eastern district manager for the Graybar Electric Company. Mr. Metz will make his office in the Graybar-Varick Building at 180 Varick Street, New York City. He will succeed W. J.



H. METZ

Drury, vice president and eastern district manager, who is retiring after 42 years of company service.

At the December meeting of the Board of Directors, Mr. Metz was also appointed a member of the Executive Committee of the Graybar Electric Company.

A. C. Lamperti was elected a director of the company. Mr. Lamperti, was named Graybar secretary and comptroller in 1943 and will continue

these duties in conjunction with his directorship.

H. L. Harper, Pacific district manager at Los Angeles, was designated a voting trustee. Mr. Harper who joined the company in 1903 replaces W. J. Drury of New York in this capacity.

WESTINGHOUSE SUPPLY CHANGES

B. H. Boatner, former branch manager, Wesco, Tampa, Fla., has been appointed manager of the northwestern district (Chicago) of the Westinghouse Supply Company. He succeeds Frederick J. Schmidt, who has retired.

The position of northwestern district supervisor of purchases is being filled by Elmer Gegenwarth.

G. H. Lineberry, formerly district apparatus and supplies manager, Wesco, Pittsburgh, recently assumed management of construction and contractor activities in the Philadelphia area.

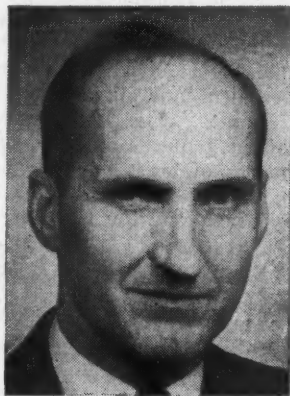
John A. O'Rourke, former Columbus, Ohio apparatus and supplies salesman of Wesco, was recently appointed manager of that district.

R. L. Whitney was appointed district apparatus and supplies manager of the east central district. He will be located in Pittsburgh.

C. R. Taylor, former apparatus and supplies salesman of the Norfolk branch, has been named branch manager.

A. W. GILMORE NAMED MANAGER OF G-E WIRE & CABLE DIVISION

A. W. Gilmore has been appointed manager of a new General Electric Wire and cable division. The new division is a consolidation of the former



A. W. GILMORE

York, Pa. wire and cable division and the Bridgeport wire and cable division. Mr. Gilmore is responsible for engineering, manufacture and sales of this division.

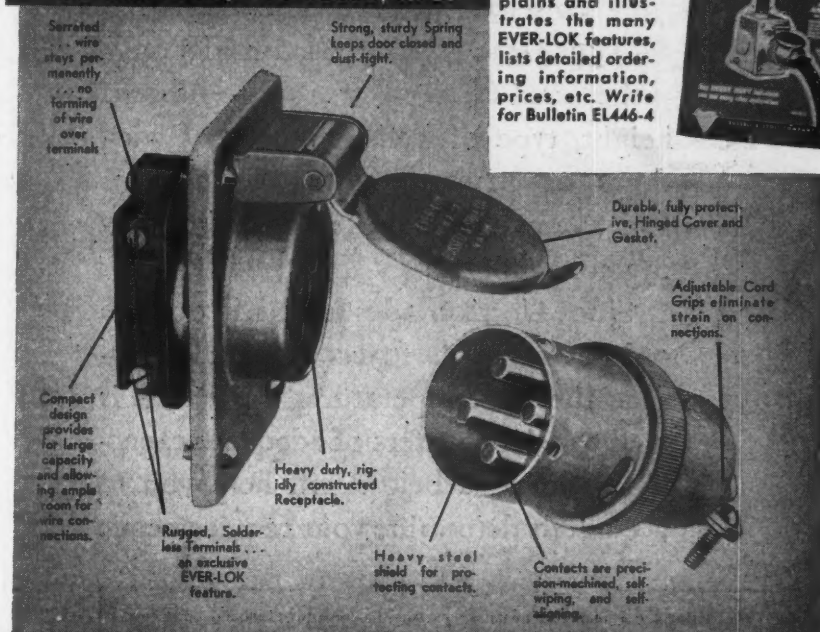
Mr. Gilmore has named the following men to assist him in the new division: M. H. Owen as manager of the York

New EVER-LOK RECEPTACLES, PLUGS & CORD CONNECTORS

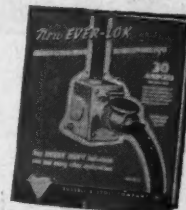
FOR HEAVY DUTY AND HIGH CYCLE APPLICATIONS

Here's a sturdy, 30 ampere, 440 Volts, A.C., capacity unit that means more jobs for you . . . more profits from installations everywhere . . . in industrial plants, factories, office buildings, department stores, hospitals, hotels, institutional buildings, and for many other heavy duty and high cycle applications. It's designed for easy, convenient wiring connections, and quick accessibility. And, of course, built by Russell & Stoll means the finest, sturdiest, and most advanced type unit available.

30 AMPERES, 440 VOLTS, A. C.



This Bulletin explains and illustrates the many EVER-LOK features, lists detailed ordering information, prices, etc. Write for Bulletin EL446-4



TYPICAL APPLICATIONS for EVER-LOK 30 AMPERE 440 VOLTS, A. C. RECEPTACLES, PLUGS AND CORD CONNECTORS.



DISTRIBUTED THROUGH
ELECTRICAL WHOLESALERS

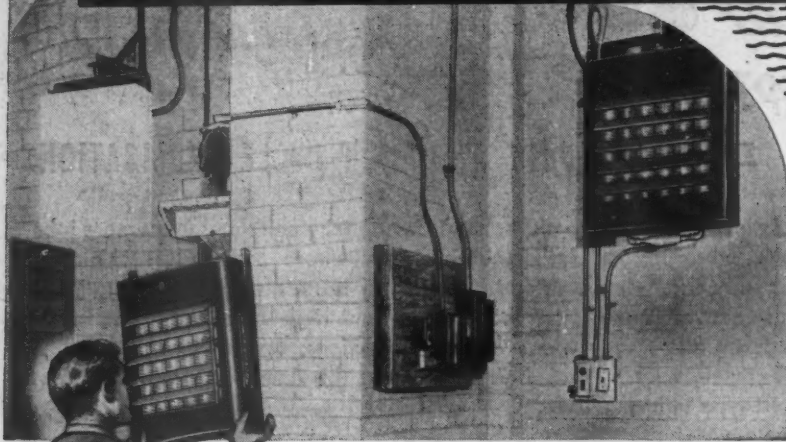


RUSSELL & STOLL COMPANY, INC.

Precision-Built Electrical Equipment

125 BARCLAY STREET, NEW YORK 7, N. Y.

HOW TO SELECT THE CORRECT UNIT HEATER CAPACITY



To select the correct Electromode Unit Heater, you need consider only the usual factors—area to be heated, height, type of walls, number of windows or other openings, insulation, and average outside temperature during cold months.

Since Electromodes normally operate only at intervals to economically provide the air temperatures desired, it is well to select heaters of adequate capacity. The table below will help you to accurately determine your requirements.

FOLLOW THIS TABLE

The Watts per Cu. Ft. method of roughly estimating heater capacity required varies as follows:

- | | WATTS |
|---|-------------|
| 1. Interior room, little or no outside exposure..... | 1. |
| 2. Average room, moderate window and door exposure..... | 1.25 to 1.5 |
| 3. Room with large window and door spaces..... | 1.75 to 3. |
| 4. Isolated exposed cabins, guard houses, etc..... | 3 to 5. |

Example (a) Interior room 14 x 20 x 10=2800 cu. ft.

2800 x 1=2800 watts heater capacity—Select 3 KW Electromode.

Example (b) If average room with large window exposures, use factor 1.75.

2800 x 1.75=4900 watts—Select a 5 KW Electromode.

In areas where temperatures of zero or below maintain regularly—use larger factors.

ELECTROMODES PROVIDE THESE ADVANTAGES:

- ✓ Heat provided exactly where needed.
- ✓ Exclusive sealed-in finned aluminum cast heating element.
- ✓ Safety from fire, shock or explosion.
- ✓ Can be located anywhere that wires can be strung.
- ✓ No energy lost or wasted between source and Heater.
- ✓ No energy consumed except when "ON".
- ✓ Simple, instant control, manually, or automatically by means of thermostats.
- ✓ No odors or vitiation of air.
- ✓ Re-location easily accomplished.
- ✓ No piping, fittings, or pipe coverings to maintain.

Electromode Corporation, 53-1 Crouch St., Rochester 3, N. Y.

ELECTROMODE

Electric Unit Heaters



Complete data
in Bulletin
45-U. Write
for a copy.

sales section; A. E. Newman as manager of the Bridgeport sales section; C. O. Hull as engineer; S. T. Powell as manager of manufacturing; and A. Hillman as accountant.

BENJAMIN ELECTRIC APPOINTMENTS

The Benjamin Electric Mfg. Company of Des Plaines, Ill. has announced the appointment of Raymond W. Corwin as manager of the eastern division. Mr. Corwin will be responsible for sales operations in Alabama, Connecticut, Delaware, Washington, D.C., Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont and Virginia.

Carl O. Martin, formerly assistant manager of the Pacific Coast division, has been named manager, responsible for sales operations in Arizona, California, Idaho, Montana, Nevada, Oregon, Utah and Washington. Mr. Martin succeeds Miles F. Steel, formerly vice president in charge of the company's Pacific Coast division, who has retired after 35 years of continuous service with the company.

B. F. JAKUES ELECTED PRESIDENT OF COUCH CO.

At a recent meeting of the board of directors, B. F. Jaques was elected president and board member of S. H. Couch Company Inc., No. Quincy, Mass. He succeeds Samuel H. Couch, founder and for many years president, who becomes chairman of the board. J. Eric Atkinson remains as vice president in charge of sales and Donald F. Cameron continues as treasurer. Charles J. Winkler, Jr., the firm's legal advisor, was elected to the board.

Archie T. Morrison has resigned as vice president and director.

Mr. Jaques, who will continue as head of the Jaques Company, national distributors of brass, bronze and aluminum products, is a director of the Kinney Manufacturing Company.

NEW SALES OFFICES OPENED BY R-B-M

Sales offices have been opened in Philadelphia, Kansas City, Milwaukee, San Francisco and Los Angeles by the R-B-M Division, Essex Wire Corporation of Logansport, Ind.

The Philadelphia office is located at 6816 Market Street, Upper Darby, with R. E. Clayton in charge. The Kansas City office is located at 121 East 27th Street, with P. D. Rensenhous, Jr. in charge. The Milwaukee

office at 312 East Wisconsin Avenue, with James Paton in charge.

In California, W. D. Barnes is in charge of the San Francisco office, located at 1077 Howard Street, and J. W. Stewart is in charge of the Los Angeles office located at 2030 Sacramento St.

KELLOGG APPOINTMENTS

Kellogg Switchboard and Supply Company of Chicago has announced the appointment of Col. Edgar L. Love as manager of the Koiled Kord Division. Col. Love was formerly chief of production of the Central District, Army Air Corps, and plant representative of the Dodge Chicago plant.

The Morris F. Taylor Company, Silver Springs, Md. has been appointed southeastern states distributors for the Koiled Kord Division. They will cover southern New Jersey, eastern Ohio, Pennsylvania, West Virginia, Delaware, Maryland, District of Columbia, Virginia, North and South Carolina, Tennessee, Alabama, Mississippi, Georgia and Florida.

Jack Lasser, founder and president of Mastercraft Electric Company of Newark, N. J. has resigned and sold his interest in the company to start a new organization. The new company, the Lasser Mfg. Company, will enter production on a complete line of modern fluorescent lighting fixtures and lamps. General offices will be located at 40 N. E. 22nd Street, Miami, Fla.

Ward Leonard Electric Co., Mt. Vernon, N. Y. announces the appointment of Storer and Schem, Transportation Building, 307 East Fourth St., Cincinnati, Ohio as its new industrial sales representative in Southern Ohio, Eastern Kentucky, Western West Virginia, the counties of Clark and Floyd in Indiana.

C. Lynn Wright has rejoined the Bull-Dog Electric Products Co., Detroit, after four years of service with the Army, and has been assigned to the Philadelphia, office. He was a major in the Signal Corps and served abroad in India and Burma.

Potter Instrument Company, Flushing, N. Y. has announced the appointment of John J. Wild as sales manager. Mr. Wild was formerly assistant sales manager of the Television Equipment Sales Section of the General Electric Company.

Electrical Contracting, January 1947



*"I know they're good...
they're KLEINS*

"If you've ever worked on a pole 50 feet in the air with the wind whistling around your ears, you know why linemen need good tools. That's why there'll always be a pair of Kleins in my tool belt. I know they're good."

Yes, to the men who install and maintain the nation's power and communication lines there is only one kind of pliers... Kleins. There's a sound reason for this overwhelming preference. For linemen and electricians—men who know good tools—also know of the quality materials and handcraftsmanship that go into every pair of Kleins. To them this excellence means speed, efficiency and safety on every job.

The complete line of Klein Pliers is in full production but demand still exceeds supply. Your supplier will fill your order as soon as possible.

ASK YOUR SUPPLIER

Foreign Distributor:

International Standard Electric Corp., New York

A copy of the Klein Pocket Tool Guide, showing the Klein line and containing valuable tool information, will be sent on request.



Mathias KLEIN & Sons
Established 1857

Chicago, Ill., U.S.A.

3200 BELMONT AVENUE CHICAGO 18, ILLINOIS

SOLDERLESS—TAPELESS

Wire Connectors



SOLAR

SCRUIT

MR. SCRUIT Trade Mark

Solar SCRUITs are used for connecting two or more wires without tape, solder, flame or tools. They are economical and easy to use—wire ends are stripped and SCRUITs screw right on to form a compact and efficient joint.

SCRUITs give better mechanical and electrical contact . . . eliminate possibilities of shorts, grounding and corrosion. Their compact size permits their use where working space is at a minimum.

Available in several sizes for connecting various combinations of wires.

EASY TO USE:

1. STRIP WIRE



2. SCREW IT



3. THAT'S IT with SCRUIT!

MILLIONS-IN USE • HUNDREDS OF APPLICATIONS

"Roughing-in" or permanent wiring is simplified with SCRUITs . . . they thread on with a twist of the wrist . . . and the joint is complete!

- Fixtures
- Outlet Boxes
- Fuse Boxes
- Panel Boards
- Switch Boxes
- Lighting Devices
- Conduit Boxes
- Circuit Breakers
- Switch Controls
- Motor Connections

and many others.

U. S. PATENT NO. 1,933,555

**DON'T TAPE
DON'T SOLDER
"SCRUIT"!**



• MADE IN FOUR SIZES

• MAY BE USED WITH SOLID OR STRANDED WIRES

**Write for Data
Sheet U-1.**

For complete specifications on SCRUIT sizes, uses, prices, etc., WRITE TODAY.

SOLAR ELECTRIC CORPORATION

FACTORY and SALES OFFICES
WARREN, PENNSYLVANIA

Portable Products Corp., Pittsburgh, has purchased the Great Western Fuse Co. and the LaMar Indicating Fuse Corp., both of Pittsburgh. These two companies will be operated as subsidiaries with no change in personnel nor in method of operation.

Simplex Wire & Cable Co. of Cambridge, Mass. has appointed W. W. Lancaster as sales representative in the New Orleans area. He will cover the states of Mississippi, Louisiana, Arkansas and western Tennessee.

Independent Pneumatic Tool Company announces a \$1,000,000 expansion of its main works at Aurora, Ill. Site for the expansion has been cleared adjacent to the company's main plant, and construction of the annex, which will provide 85,000 square feet of additional floor space for production purposes, will begin shortly.

W. R. Freeman, general sales manager of the Lighting and Appliance Division of the Wabash Corporation, has resigned to accept the position of vice president in charge of sales of Lustra Corporation of America and its affiliated company, Amplex Corporation, both of New York City.

Lou Alexander has joined the Eastern sales force of the Cornell-Dubilier Electric Corporation, South Plainfield, N. J. He will specialize in application engineering.

Auth Electric Company, Inc. are now located in their new building at 34-20 Forty-Fifth Street, Long Island City, N. Y.

The New York offices of Appleton Electric Company, Chicago, are now located at 50 Church Street, New York 7, N. Y.

The St. Louis office of Insulation and Wires, Inc. has moved to new offices at 3435 Chouteau St.

Donald T. McCoy of Chicago, has been assigned to the Ohio sales territory for the Beldon Manufacturing Company.

SCRAMBLED PHASE TRANSMISSION [FROM PAGE 54]

tains a smaller removable section to permit inspection and facilitate the installation of additional taps should the necessity for them arise. Weatherproofing is achieved through the utilization of gaskets and fibre washers beneath each nut and bolt head. In traveling from switch house to seventh floor tap, the exterior 4000 amp. bus duct extends 291 feet horizontally and 92 feet vertically. The total weight of this duct work exceeds 17 tons.

In comparison to any possible interior installation, the erection of the weatherproofed duct work involved few difficult problems although many special duct sections had to be constructed to include right-angle and oblique turns, steps, transitions from the vertical to horizontal plane, transposition housings and taps. (Dwg. 1-E).

Vertically rising steam pipes 12 inches from the face of one building made it necessary to run the duct on edge with covers on the side. Passing this point, the bus duct was stepped downwards at a right angle to place the section covers on top and to utilize the support of an existing I-beam pipe-run cradle between two of the buildings.

The fifth floor future service tap is capped with an ebonized asbestos seal (Dwg. 1-C) while the seventh floor terminal section includes a second major transposition (Dwg. 1-B) in which the phases are unscrambled and regrouped prior to the entrance into the housing for a pair of 2000 amp. circuit breakers.

Although the seventh floor breaker cabinet has provisions for serving two 2000 amp. circuits, only one line is connected at the present time. This single feeder duplicates the high efficiency design of the exterior installation although the metal housing differs in dimensions (being of 16 gage, 11 by 14-inch galvanized steel), is of standard, rather than weatherproofed construction and contains three rather than six pairs of split-phase 4 by 3/4-inch conductors. (Dwg. 2-F).

Transposition at the 2000 amp. breaker cabinet (Dwg. 2, Details B and D) scrambles the phases for low loss transmission through the 277 foot run. With mounting channels bolted snugly to the ceiling, standard duct sections are suspended with covers on the bottom to facilitate inspection and permit auxiliary tapping while maintaining maximum clearance above the floor.

WHEN YOU MEET A

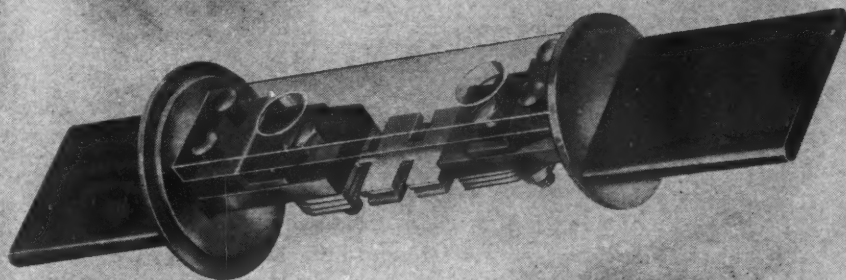
Monarch Fuse



FACE TO FACE....

You are Impressed with the Amount of

B R A S S



INSIDE

AS WELL AS...



OUTSIDE

Monarch Renewable Fuses

are famous for

BETTER HEAT DISSIPATION

and

EXTRA LONG SERVICE



AVAILABLE THROUGH RECOGNIZED WHOLESALERS

MONARCH FUSE CO., LTD.

118 E. FIRST ST.

JAMESTOWN, N. Y.

The New Home of **Lloyd** PRODUCTS



Lloyd appreciates the patience and forbearance you have shown when overloaded manufacturing facilities slowed down delivery of Lloyd Flex-Loc Lamp Holders and Lloyd Automatic Starters. We are now at home in this large modern plant, where greatly increased facilities will make possible greater service to all our customers . . . service which we hope will match in quality the matchless Flex-Loc Lamp Holders and Lloyd Automatic Starters.

LLOYD POLICY INSURES QUALITY



651-F
FLEX-LOC Lamp Holder

Automatically self-adjusting. Engineered to fit ALL STANDARD spacings. POSITIVE AUTOMATIC LOCK. PERFECT ELECTRICAL CONTACT. Brass contacts grip BOTH sides of lamp pins securely.

Listed and Approved by
Underwriters' Lab., Inc., and
Canadian Standards Assoc., App. Division
E.T.L. Test Report 314454 Available
Patented—Other patents pending

FS-40

AUTOMATIC Starter
CUTS OUT deactivated or flickering lamps. CUTS OUT current to lamp and ballast. Increases life of lamp and ballast.

Listed and Approved by
Underwriters' Lab., Inc.
Certified by E.T.L., Spec. 6
Pat. Nos. 2200443-2228210



LLOYD PRODUCTS CO.
PROVIDENCE 5 RHODE ISLAND

Branch offices and Warehouse Stocks in 27 Leading Cities

In the final transposition section (Dwg. 2, Details C and E) the phases again are separated (two bars per phase) and tapped by three sets of 2 by 1/4 inch connecting links that protrude through a 1/2 inch insulating ebony panel beneath three 600 amp. circuit breakers spaced on 2 foot centers.

Cable-conduit sub feeders from these three breakers deliver 440 volt, three phase, three wire current to distributing plug-in bus ducts. Suspended by inverted stirrup hangers, these bus ducts constitute a rugged network of high capacity, flexibility-promoting, conveniently spaced power outlets. Dry type 37.5 kw. transformers alter power characteristics to 3 phase, 4 wire, 120/208 volts for lighting.

Wide use is made of rubber covered cables between distributing plug-in bus duct and powered machinery. These connections permit maximum flexibility of plant equipment and also eliminate the possibility of vibrations disturbing rigid connections, creating shorts and endangering operators through shock. Plug-in outlets remain covered when not in use, maintaining the designed electrical protection of the current carrying enclosed busses.

During the two decades since 1927, when enclosed busbar systems were first utilized for plant distribution by the automotive industry, great progress has been made in mechanical design which has controlled temperature rise and regulated voltage. Improvements are constantly being introduced due to research and practical field experience and the performance data of the Carrier installation should contribute to the increasing volume of technical knowledge being compiled on high efficiency busway distribution systems.



Reminiscing about old times are Otto E. Radtke (left), chief electrical inspector, Cleveland, Ohio and his predecessor A. J. "Jerry" Pickett who is now manager of the Greater Cleveland Chapter, NECA.

They use **RIGID** and
THIN-WALL conduit



They often have to
CHANGE FITTINGS



Fittings must resist
constant **VIBRATION**



**What a Spot for
KONDU!**

Only with Kondu fittings
can you use Thin-Wall
Tubing at any outlet . . . and
take one fitting out of the
line and put in another, with-
out disturbing conduit. And
Kondu fittings hold perma-
nently tight . . . vibration
proof. Practically unbreak-
able . . . 100% re-usable.

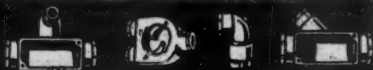
Write for the Kondu Catalog

KONDU CORPORATION

Erie, Pa.

KONDU MFG. CO. LTD., Preston, Ontario

KONDU



The Threadless Fitting Line
of Unequaled Variety



SYNTRON

DEPENDABLE

**ELECTRIC
HAMMERS**



**Will Drill—Cut—Channel in
Concrete and Masonry
IN 1/10th THE TIME**

it takes you to do the same jobs with a
hand hammer and drill.

Their 3600 blows per minute from the
ordinary 110 volt A.C. light source, save
you money and time.

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690 Lexington

Homer City, Pa.



Sell more

Light!

with *COLOVOLT

COLD CATHODE • LOW VOLTAGE LIGHTING

For greater customer satisfaction.

Lower maintenance cost —
longer maintenance of a given
foot-candle level—greater de-
pendability because of guarantee
(One year of light guaranteed
except for failure due to break-
age)—instantaneous starting—
no flickering — continuous line

lighting. These extra advantages
are available to commercial and
industrial users of light when in-
stallations are made with COLO-
VOLT Cold Cathode, Low Volt-
age Fluorescent Lamps and
Fixtures.

*Write for illustrated material
and technical data.*



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RELIANCE AUTOMATIC TIME SWITCHES



Model "W"

Completely automatic
... extremely simple,
compact, economical
... three types cover
practically every re-
quirement ...

ASTRONOMIC TIME SWITCH

• The Model "W" Astro-
nomic types are particu-
larly popular for advertis-
ing illumination. The "on"
operation changes daily to
correspond with local sun-
set time, eliminating the
necessity of re-setting the
dial as the days become
longer or shorter.

AMERICA'S RELIABLE 24 hour-a-day GUARDIANS

RELIANCE Time Switches have proved their dependability. They give complete and reliable service under many varied conditions—a factor of paramount importance when constant good service is essential. Send for catalog and price sheets for complete details.

RELIANCE AUTOMATIC LIGHTING CO.

1907 MEAD STREET

RACINE, WISCONSIN

LIGHTING PROGRAM FOR CONTRACTORS

(FROM PAGE 511)

classifications representing 75 percent of all stores can be estimated for any community through use of a key, based on "stores per thousand population". The key for these eight classes are: food stores, 2.87; restaurants, 1.34; barber and beauty shops, 1.26; specialty shops, .61; drugs, .46; candy, .43; hardware, .26; and general merchandise and dry goods, .27. These figures are average for the United States as a whole.

New stores will be opening up at a rate that is unprecedented in our history, just as soon as housing needs have been met sufficiently for the Government to relax or abolish its Housing Order. These stores are required by the hundred thousands to supply the American public with necessities, comforts and conveniences of peacetime living. They all must and will be lighted with the right kind of lighting—dynamic, sales-promoting lighting which creates atmosphere, stimulates attraction, aids appraisal. It is around these three A's of lighting, considered fundamental for store illumination, that much of the lighting program for contractors has been planned.

The Tools—Until recent years store lighting has been primarily utilitarian, and has done little more than banish darkness. The many new developments in light sources and lighting components and equipment, and many new lighting techniques, have only recently begun to be used.

The slogan, "A lamp for every lighting need", has been popular for several years. Yet new lamps are developed yearly, with improvements in efficiency, operation, color and adaptability. The contractor now has available for his store lighting jobs the well known standard line of incandescent lamps, plus many newly developed filament lamps. He also has the standard line of fluorescent hot cathode lamps, in a variety of colors and four qualities of "white" light. In addition, he has mercury vapor lamps in a range of sizes, sun lamps, germicidal and infra-red lamps, cold cathode fluorescent lamps custom made for specific lighting problems, and fluorescent long slender "Slimline" and circular "Circline" lamps. A part of each contractor meeting is devoted to a discussion and round-up summary of the characteristics and uses of these many new light sources.

Specify

ADVANCE BALLASTS

FOR UNEXCELLED PERFORMANCE



Leading manufacturers of lighting fixtures use and recommend "ADVANCE" Ballasts for QUIET operation, high efficiency performance, low replacement cost and long life, "ADVANCE" Ballasts are streamlined for easy installation in fixtures and are approved by Underwriters Laboratories.

ADVANCE TRANSFORMER CO.

1124 W. CATALPA AVE., CHICAGO 40, ILL., U. S. A.—CABLE ADDRESS: ADTRANS



RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods



RLM Threaded Dome Reflector



• QUAD Units have proved themselves in long-time service. Contractors enthusiastically endorse them because they live up to their claims—they give good lighting efficiency for long periods and require little attention. Install QUADS for industrial or commercial installations—indoor or outdoor. Good business is the result. Good . . . for today and for tomorrow.

Manufacturers of Incandescent Lighting Equipment

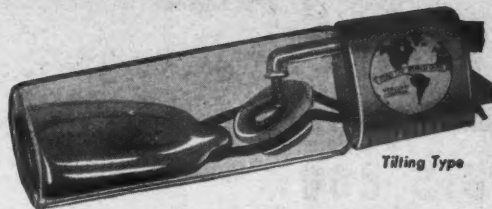
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Mercoid Switches are successfully used in many industrial applications.

There are various types available. The magnetic type, illustrated above, operates with the movement of the magnet—the tube remains stationary. The tilting type, opens and closes the circuit on a snap-action principle. Both types provide an instantaneous and positive "make" and "break" in the circuit.

Our engineering staff will assist in their application to any of your switch problems.

Further information sent upon request.

THE MERCOID CORPORATION • 4225 BELMONT AVE. • CHICAGO, ILL.

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"EFFICIENCY" DEVICES FOR CONDUIT AND CABLE SUSPENSION

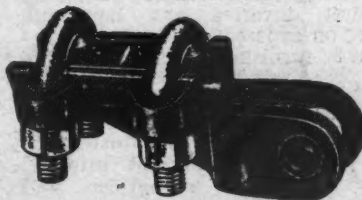


Clamps available in three sizes for Cable diameters of 1/10 to 1,500,000 cm.

EFFICIENCY CABLE STRAIN-CLAMP

... Stands Direct Pull of over 17,000 lbs. before cable slips!

By actual test, the EFFICIENCY Cable Strain Clamp will withstand a direct pull of over 17,000 pounds without permitting the cable to slip. This powerful grip results from the EFFICIENCY Clamp's "H" design, incorporating a high ridge across the center of the cable channel and a U-bolt at each end.



Adaptability to all requirements is provided in the EFFICIENCY Clamp's alternate construction . . . which may be clevis or eye, according to your requirements. Both styles are furnished for A.C. or D.C. service.

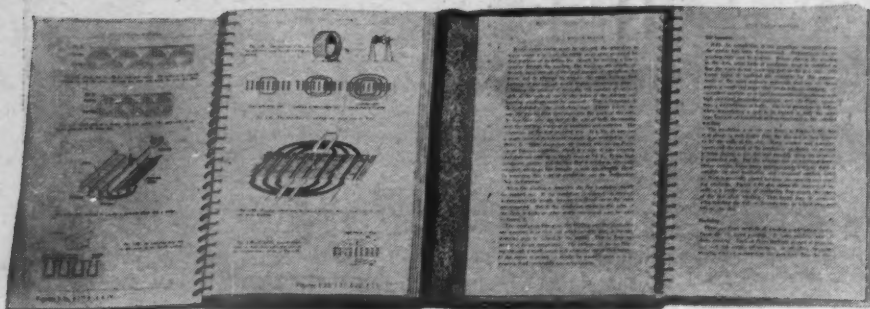
Write today for your copy of EFFICIENCY Catalog No. 38A . . . contains complete construction and application data on all EFFICIENCY Devices.



MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT, WIRE AND CABLE SUSPENSION

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A Pair of Pliers . . . A Screw Driver and . . .



THIS BOOK

is all you need to repair, rewind, connect and assemble an electric motor

Split-phase, capacitor, repulsion-induction, polyphase, Direct current — All are covered in language and diagrams anyone can understand.

The student — the apprentice — the mechanic — the foreman and the engineer will save hours of experimenting, test-

ing, tracing connections if this book is available.

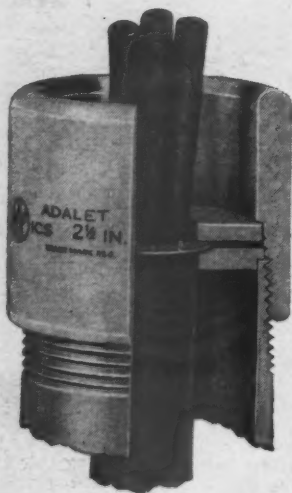
The duo-spiral binding makes both text and illustrations visible at the same time and the complete index permits quick finding of the subject desired.

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Specify ADALET SALI CABLE END SEALING DEVICES



Section 2314 of the National Electrical Code requires that: "Where a service raceway or duct enters from an underground distribution system, the end within the building shall be sealed with suitable compound so as to prevent the entrance of moisture or gases."

Adalet Cable Seals, made of Sali, are the ideal fitting for this purpose. They are used satisfactorily on lead sheath cable or on cable in conduit.

Made in four types which meet practically all requirements—upright mounting to conduit, upright mounting on exposed cable, inverted and horizontal mounting to conduit, inverted and horizontal mounting on exposed cable. Special designs can be furnished quickly and at low cost.



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MANUFACTURING CO.**

HEnderson 1356

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Lighting equipment and fixtures are also available in a wide range of types and sizes to meet the most exacting lighting requirements.

The Lighting Techniques—A given lighting problem can usually be solved many different ways. It is important to first analyze carefully the lighting result desired, and then select equipment which will produce this result. This usually includes the type of light distribution required, method of installing or mounting, amount and quality of light needed, and cost.

At each meeting a "1-3-5-10" lighting formula for store lighting is presented in detail. Its use in lighting layouts is completely demonstrated in three different ways. One is through a color sound movie, "Seeing is the Biggest Thing in Selling". Another is a color slide film with recording, "Lighting that Moves Merchandise". The third is through the solution of a practical lighting problem with the contractors, using the "Store Lighting Layout and Design Guide". Explained briefly, "one" lighting is a high level of general illumination throughout the store; "three" lighting is punch lighting to brighten counters, tables and selling areas to an intensity three times greater than the "one" lighting; "five" lighting is the addition of five times as bright light inside the floor and wall cases; and "ten" lighting is the highlighting of feature displays in niches and wall display cases at eye level which is ten times as bright as the general level of illumination.

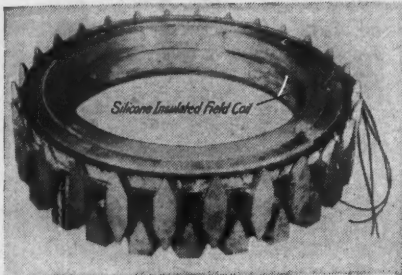
Sales Aids for Contractors—There are two types of sales aids available to contractors. The first are those aids which are used by the contractor to train himself or his salesmen how to sell *Sales Lighting* to store owners. The second consists of booklets, envelope enclosures, easels, slide film.

The greatest opportunity of all time now exists for electrical contractors. That opportunity is in *relighting America!* It is a big job—one for all segments of the lighting industry. This store lighting program has been prepared on a national scale, hinging around the electrical contractor. That is where it belongs. Lamp and lighting equipment manufacturers have geared to do their part. If this first plan works successfully—if it is fully utilized by the electrical contractors—the same kind of training and aid job in the office lighting field, and then in the industrial and residential lighting fields, is sure to be offered. And, it adds contracts, makes profits and builds prestige for the contractor.

Silicone News



DC Silicone Insulation Extends Life of Electro-magnetic Brake



PHOTO, COURTESY DYNAMATIC CORPORATION, SUBSIDIARY OF
EATON MANUFACTURING COMPANY

Protects water cooled field coil in this magnetic
field member.

In producing electro-magnetic brakes for well drilling rigs, the Dynamatic Corporation, of Kenosha, Wisconsin, tested and adopted DC Silicone Insulation. Moisture infiltration limited the life of coils treated with organic varnishes. Protected by DC 996, none of these coils has failed.

These brakes exert a variable and controllable retarding effect without friction or wearing parts. Fundamentally, they involve the rotation of an iron drum through a variable magnetic field created by stationary coils inside the drum. Eddy currents generated in the rotating drum exert on the rotor a torque which varies with the amount of current admitted to the field coils.

A heavy duty model absorbs up to 5,000 horsepower, providing speeds from 800 r.p.m. down to a rate that permits the setting of slips on the heaviest strings of drill pipe.

The permanently sealed field coils are cooled by water circulating over the field casting and eddy current members. But DC 996 excludes moisture indefinitely even at high operating temperatures. Insulation resistance remains high despite long exposure to weather when a rig is idle. And, when drilling is resumed, this resistance rises rapidly and soon reaches infinity.

DC 996 is described in leaflet No. K 3-4.

NOTE: See our Exhibit at the Electrical Engineering Exposition, New York, January 27 to 31.

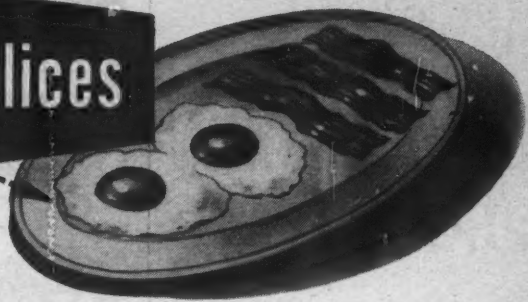
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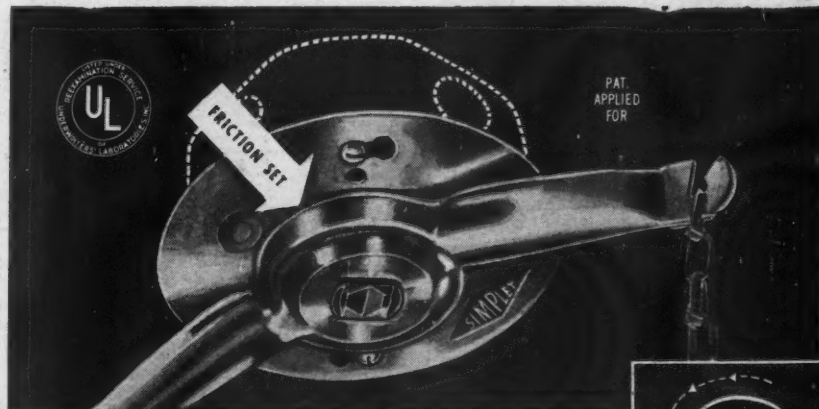
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Friction-Set K100 . . . List Price \$1.10

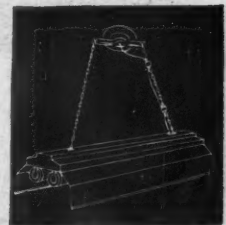
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Now only
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*Fair Trade Minimum \$5.85

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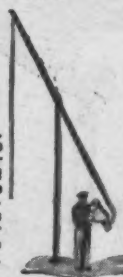
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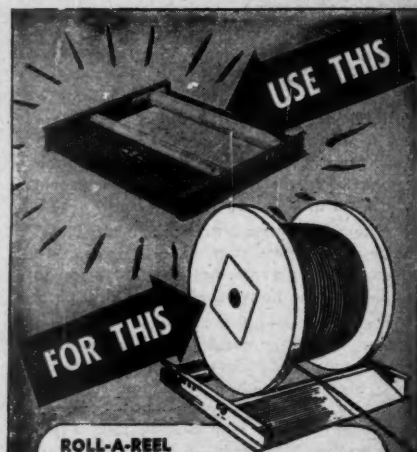
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